# Montana Bureau of Mines and Geology

*a department of Montana Tech*

- **Established in 1919 to provide reliable and unbiased earth science information**
- **Non regulatory, applied research**
  - **Geologic Mapping**
  - **Earthquake Studies**
  - **Economic Geology**
  - **Data Preservation/Mining Archives**
  - **Environmental Assessment**
  - **Groundwater Assessment and Investigations**

WATER POLICY INTERIM COMMITTEE 2017-18

August 1, 2017 Exhibit 13

MBMG
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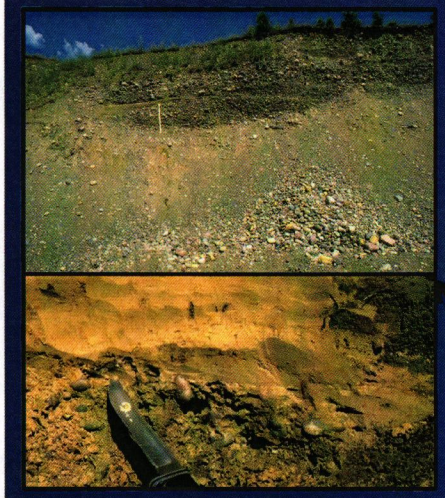
# Montana Bureau of Mines and Geology

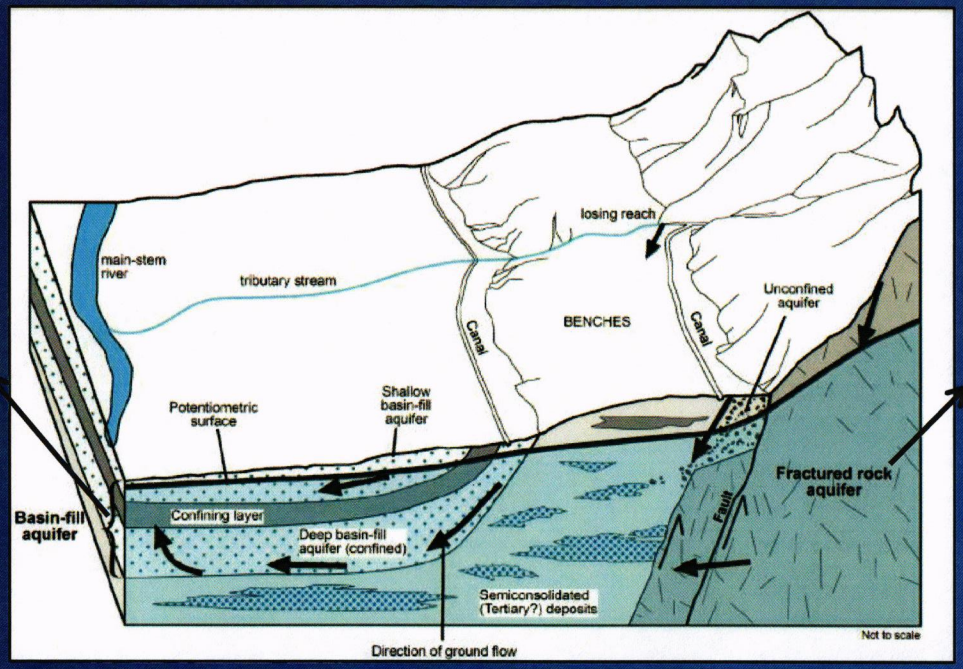
## *Ground Water: Essential Definitions / Concepts*

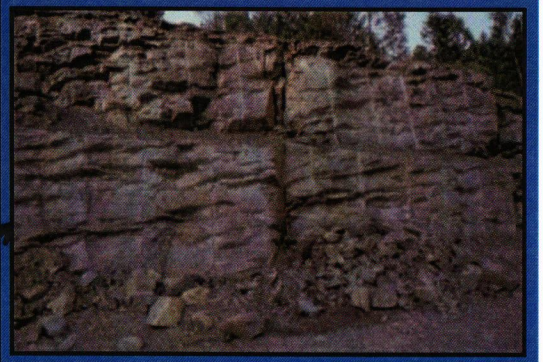
**Aquifer:**

A permeable geologic unit that can **transmit** and **store** water.

- **alluvial** (sand and gravel) or **bedrock** (sandstone, fractured rx)





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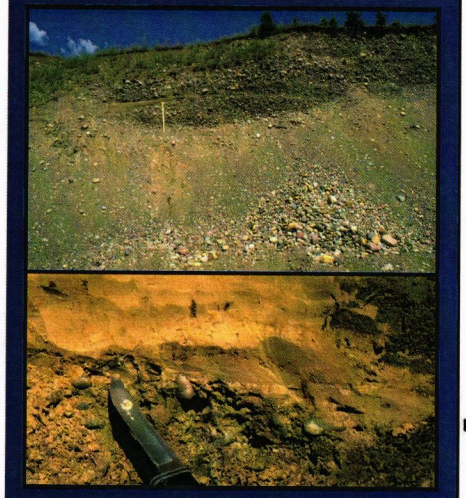
# Montana Bureau of Mines and Geology

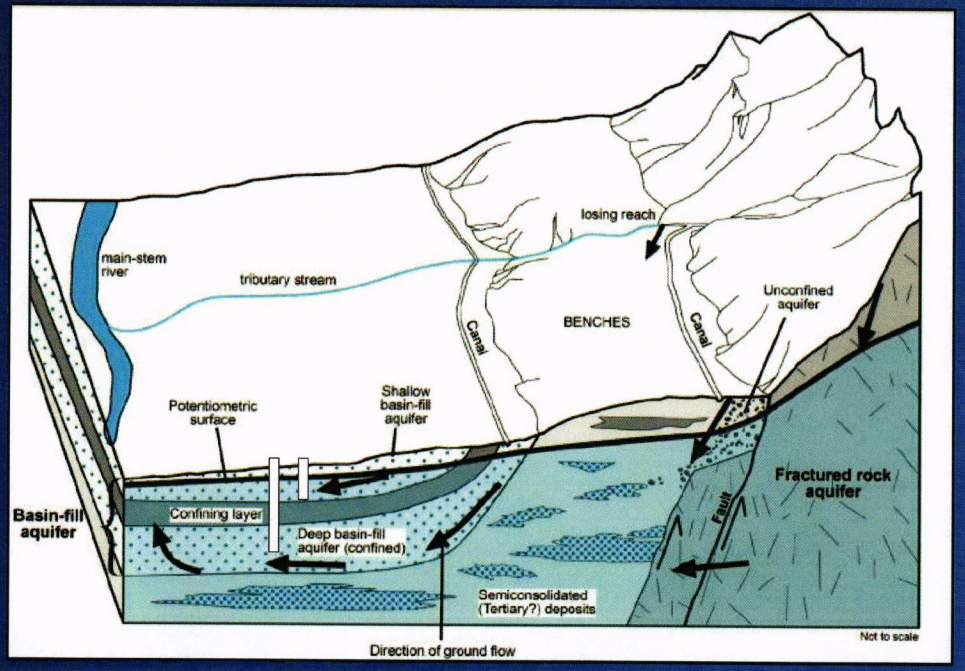
## *Ground Water: Essential Definitions / Concepts*

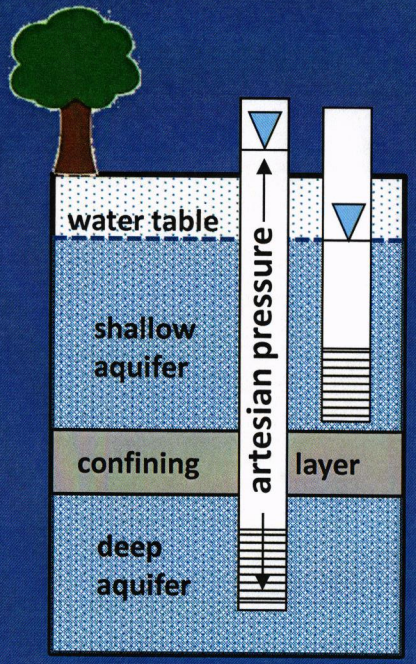
**Aquifer:**

A permeable geologic unit that can **transmit** and **store** water.

- **alluvial** (sand and gravel) or **bedrock** (sandstone/fractured rx)
- **unconfined** (water table) or **confined** (artesian)



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# Montana Bureau of Mines and Geology

## *Ground Water: Essential Definitions / Concepts*

### Groundwater and surface water are connected

**Recharge:**

- Movement of water from the land surface to the aquifer

**Discharge:**

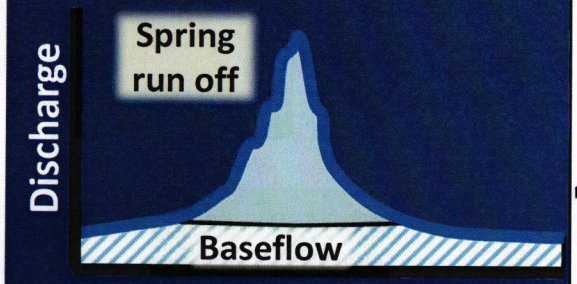
- Movement of water from the aquifer to the land surface

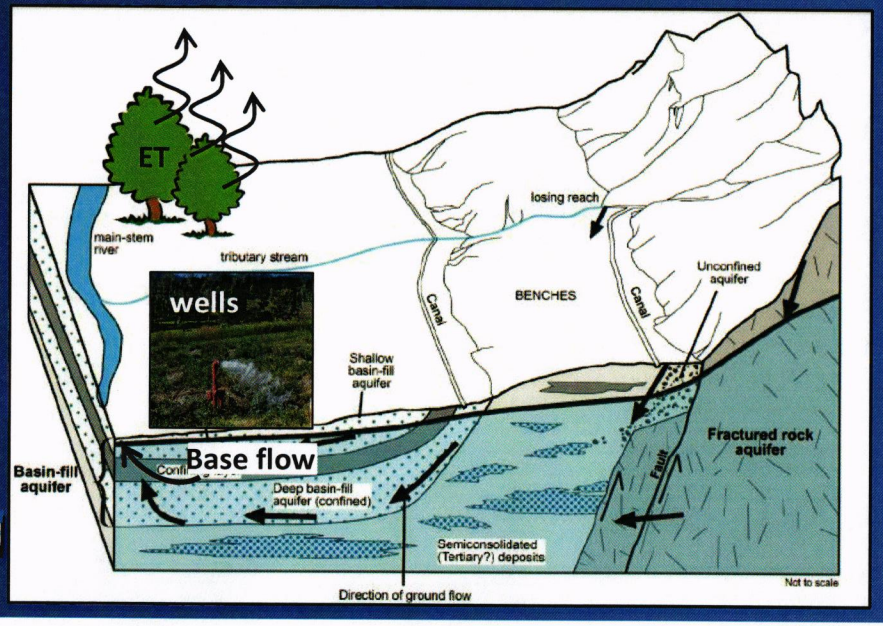
**Ground water is moving… but slowly**

- 1ft/day – 1ft/yr  Residence times: days  -  millennia

**Discharge**

- base flow
- ET
- well pumping




**Recharge**

- precipitation
- streams
- canals
- mountain front
- shallow to deep

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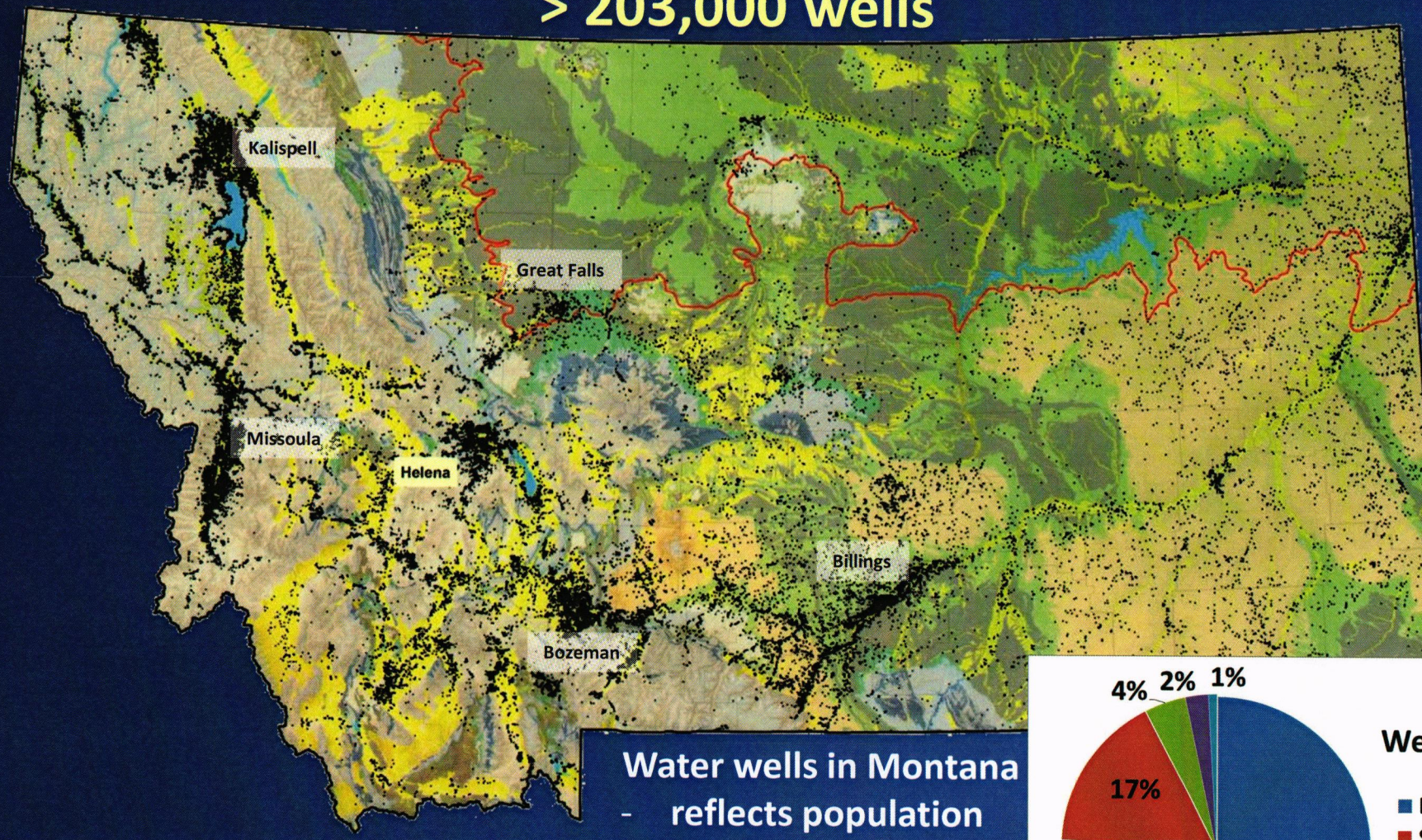
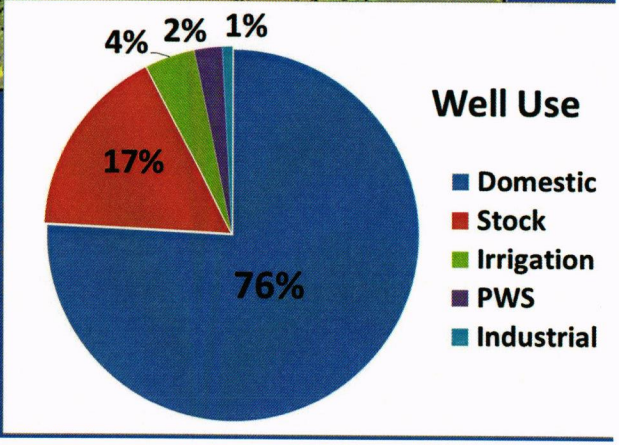
# Groundwater in Montana – Unseen Resource

## > 203,000 wells




Water wells in Montana
- reflects population
- reflects geology



# Groundwater in Montana – Unseen Resource

~ 300 Mgal/day

- 48% Public Water Supply withdrawals
- 95% rural domestic supplies
- 55% industrial withdrawals
- 30 % stock water withdrawals
- 2% irrigation withdrawals
- Sustains flow of rivers and streams

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# Montana Bureau of Mines and Geology
## *Ground Water Assessment Program*

## Legislative Directive:

- 1991 - Ground Water Assessment Act (MCA 85-2-901 et seq.)

*"assess and monitor the state's ground water and disseminate the information"*

## Program Oversight:

- Ground Water Assessment Steering Committee (MCA 2-15-1523)

*"oversee expenditures and work plans… prioritize study areas…coordinate GW projects among units of state, federal, or local government"*

## Program Funding:

- State Special Funds – HB02 FY17 appropriation: $914,968

$300,000 -- RIT interest (MCA 15-38-202)
$366,000 -- RIGWAT proceeds (MCA 15-38-106)
$248,968 -- Natural Resources Operations (NRO) account

(FY17 revenue shortfall: $159K [$93K NRO + $66K RIT])

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## *Ground Water Assessment Program*

***"...systematically assess and monitor the state's ground water and to disseminate the information..."***

- **Ground Water Monitoring**
  - Long-term records of water levels and quality.
- **Ground Water Characterization**
  - systematic data collection and interpretation.
- **Ground Water Information Center**
  - data dissemination http://mbmggwic.mtech.edu/

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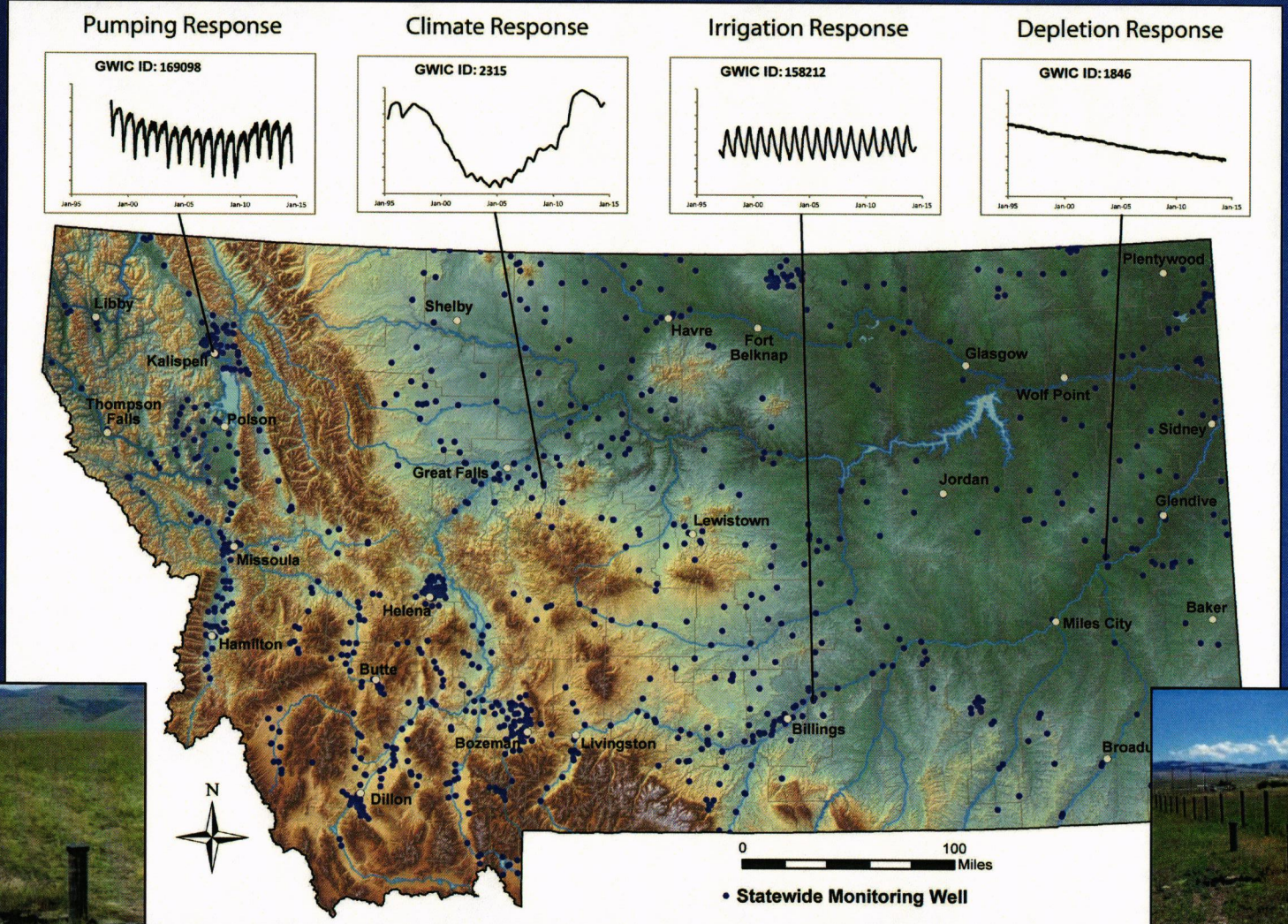
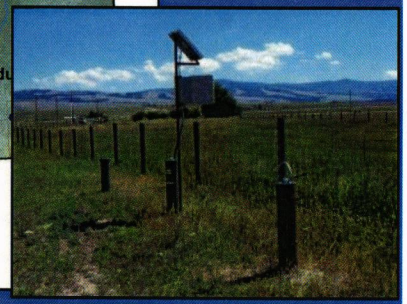
# Montana Bureau of Mines and Geology

## *Ground Water Assessment Program: Monitoring*



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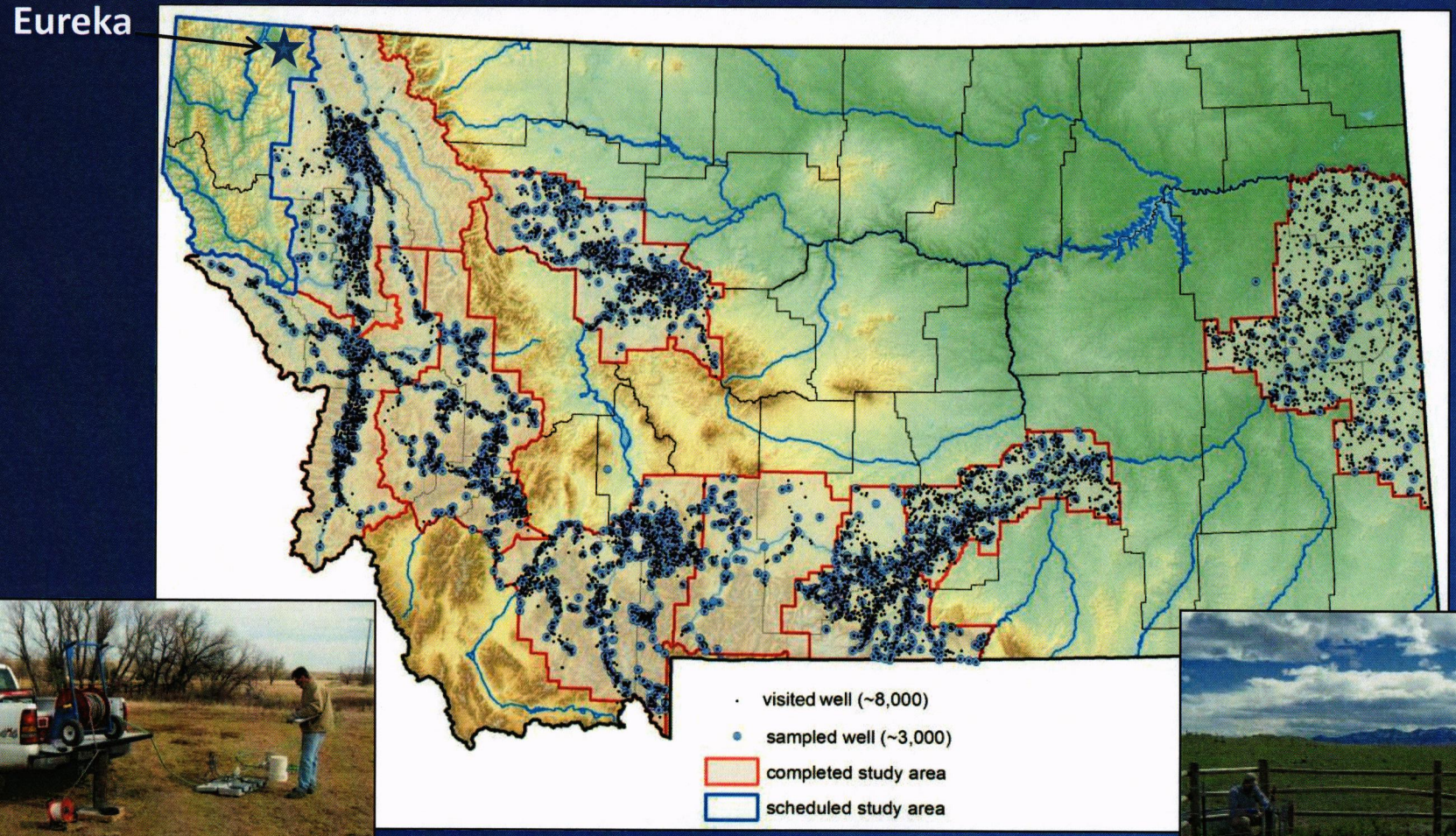
## *Ground Water Assessment Program: Characterization*

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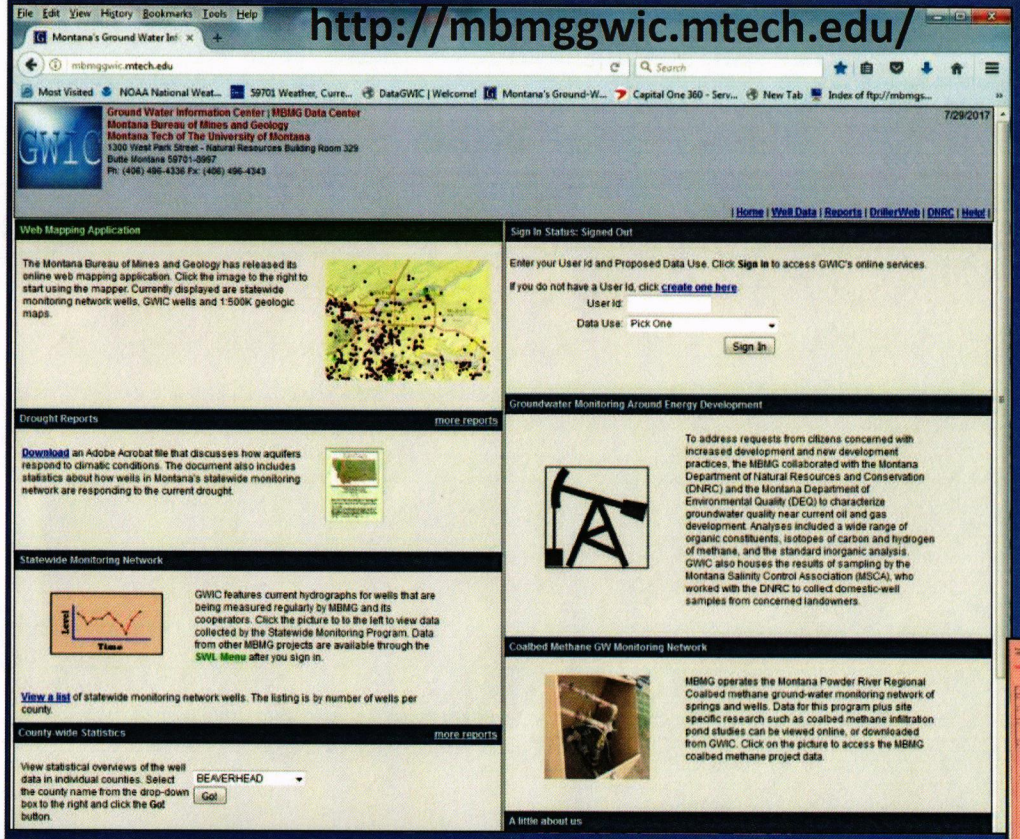
## *Ground Water Assessment Program: Dissemination*

## *Ground Water Information Center*

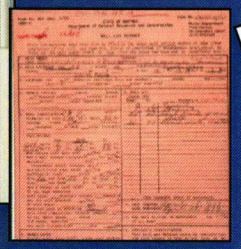
### Repository for Groundwater Information and Water Well Logs



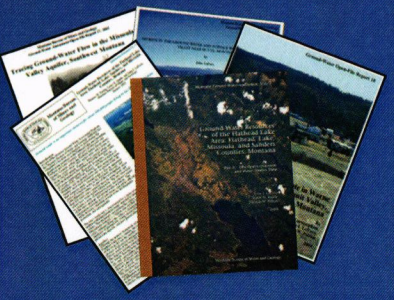

- 252,000 wells/boreholes in database
- 31,000 registered users
- 4,000 sessions each month
- 19,000 sample sites
- 26.4 million water-level measurements
- Interactive map interface
- Allows drillers to submit 'e-logs'

## Products Available:

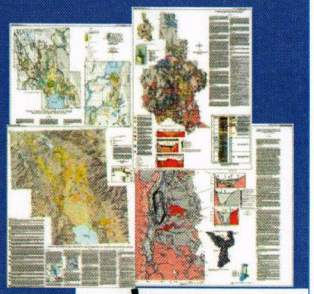
Well logs



Reports



Maps



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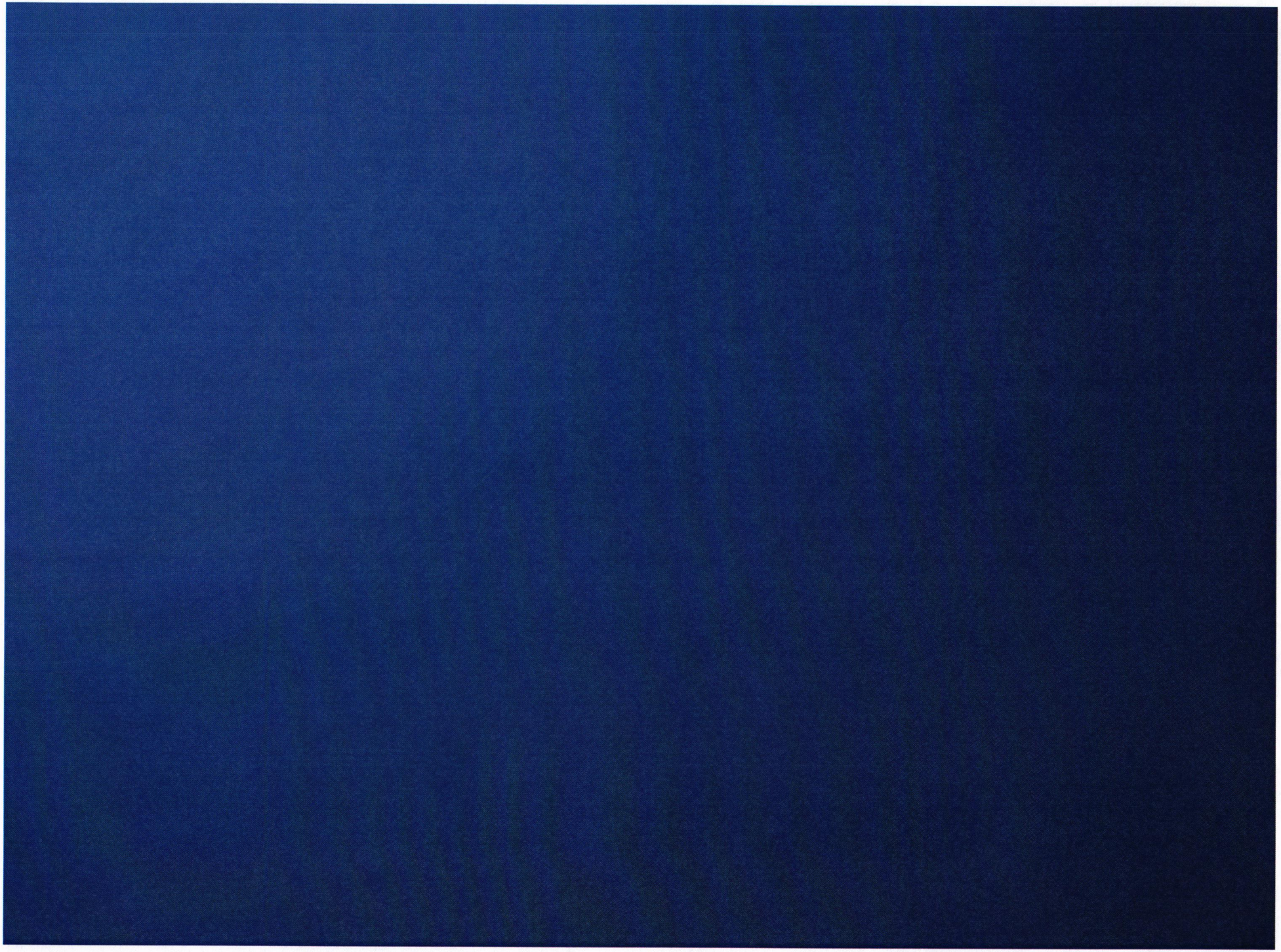
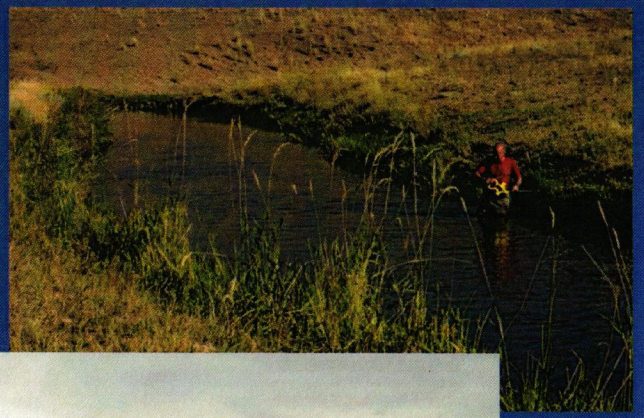
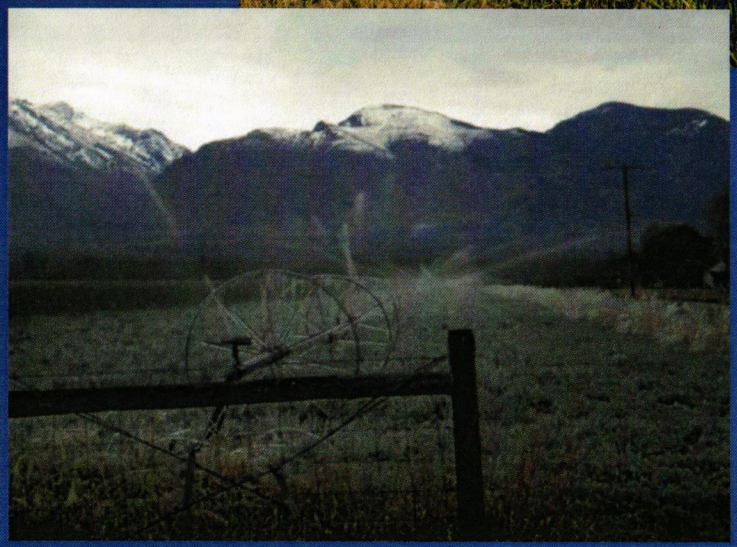


# Ground Water Investigation Program
## (GWIP)

**Addressing groundwater questions across Montana**





- ✓ Answer ***locally identified questions***, crucial for water management;
- ✓ ***Focused***, intensive studies
- ✓ ***Unbiased*** research

***Provide information so aquifers can be managed, Not just <u>used</u>***

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# Science for informed Water Resource Management


Active projects

Completed projects

Begin 2016-2017

In review

Bitterroot Valley – irrigation methods

Medicine Lake – groundwater availability

Boulder River Valley – residential development

# GWIP in the Bitterroot

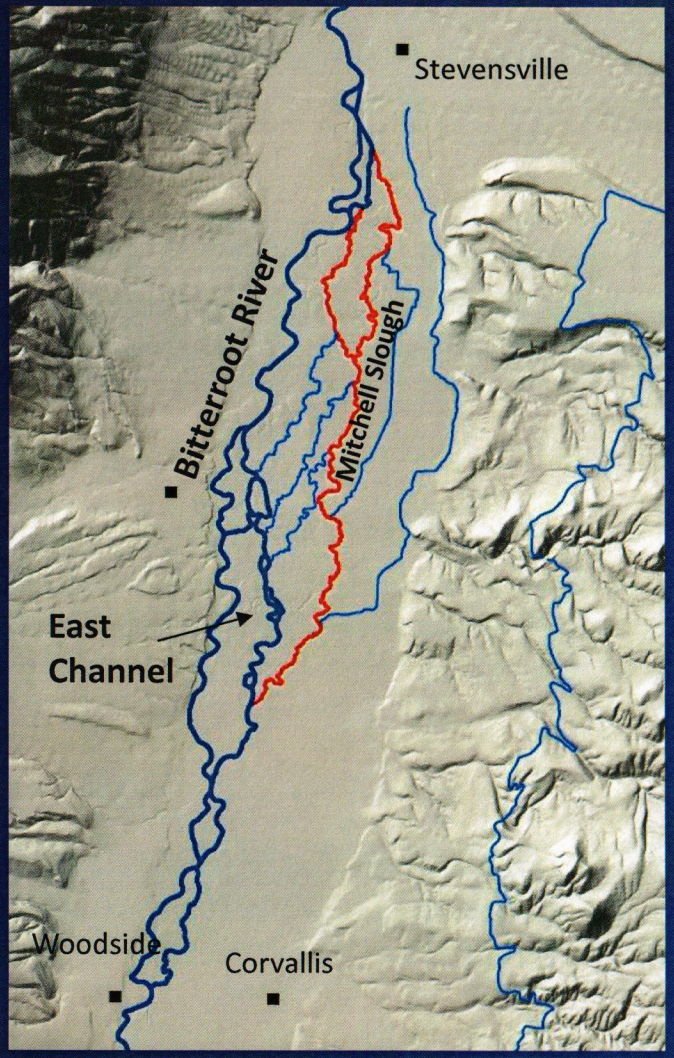



*Photo courtesy of the Ravalli County Conservation District*

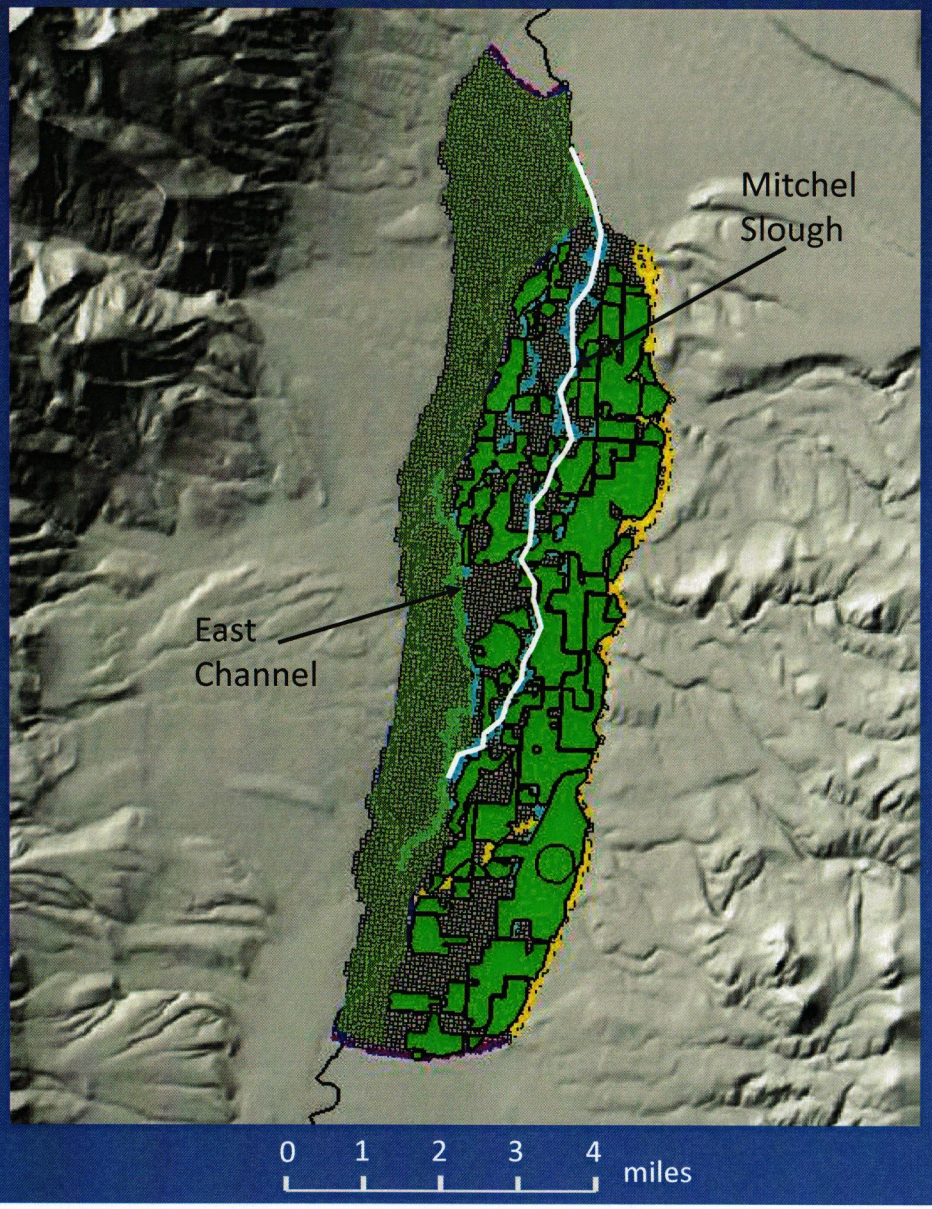
*East Channel choked with sediment*

# To divert or not divert....

# Predicting changes in hydrogeology

## Developing groundwater flow models

Groundwater recharge from irrigated fields

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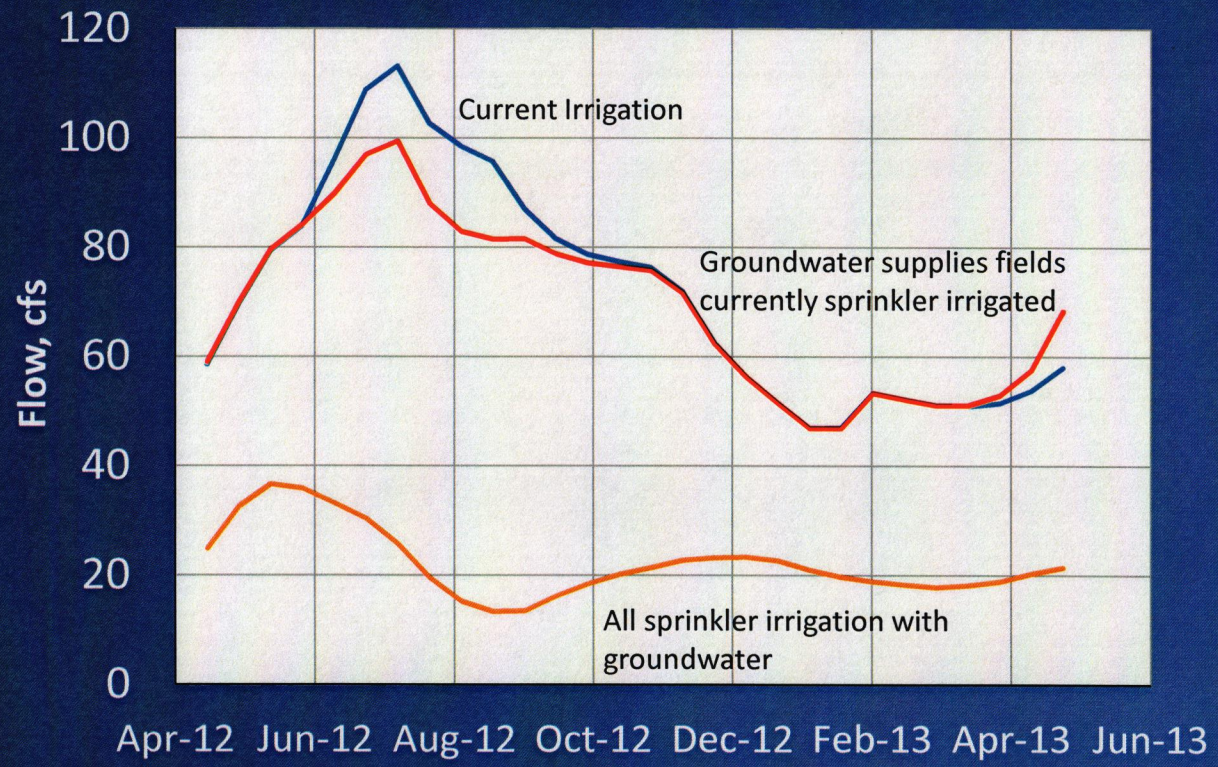
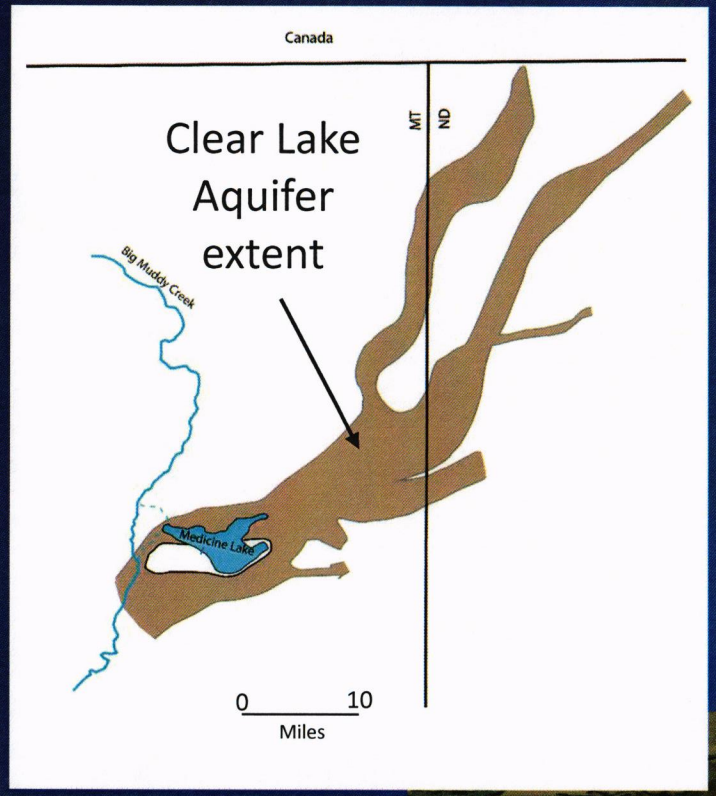
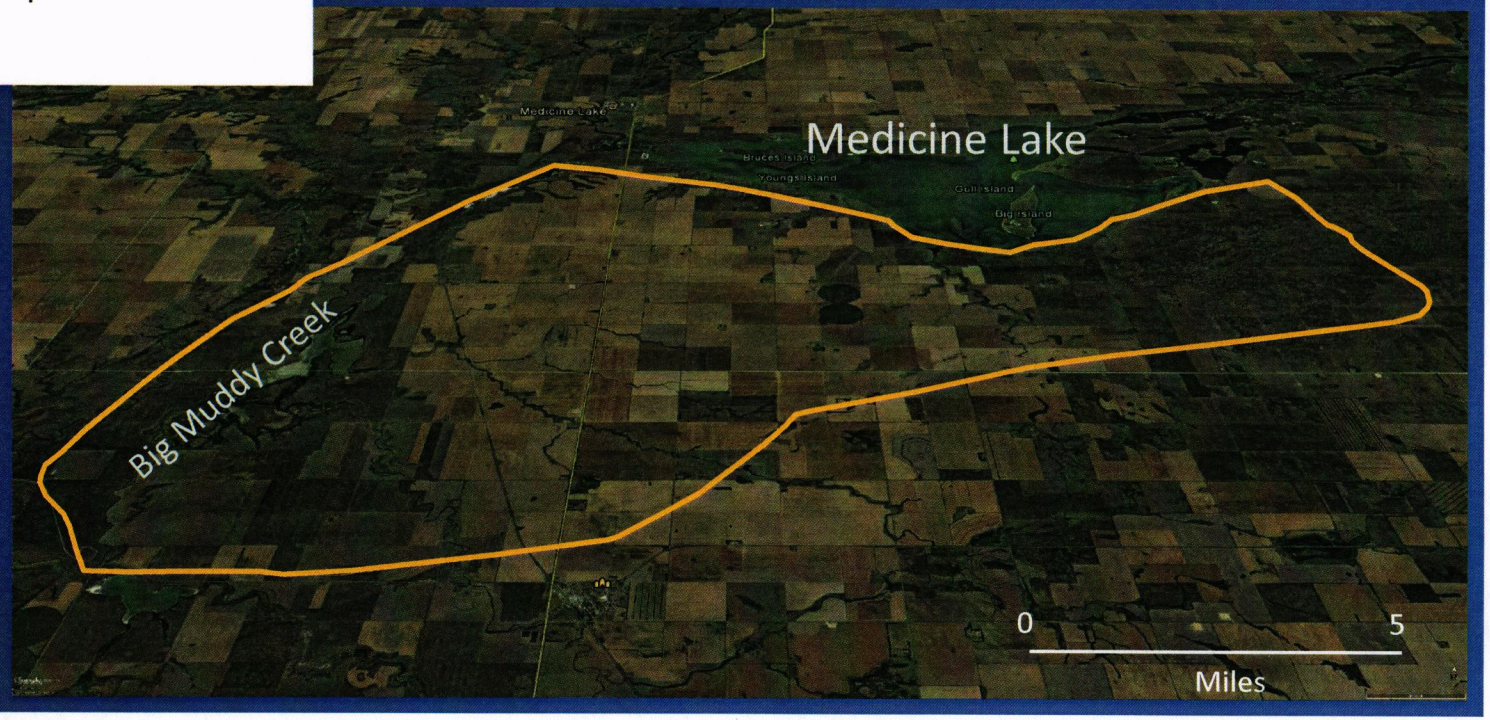
# Mitchell Slough outflow



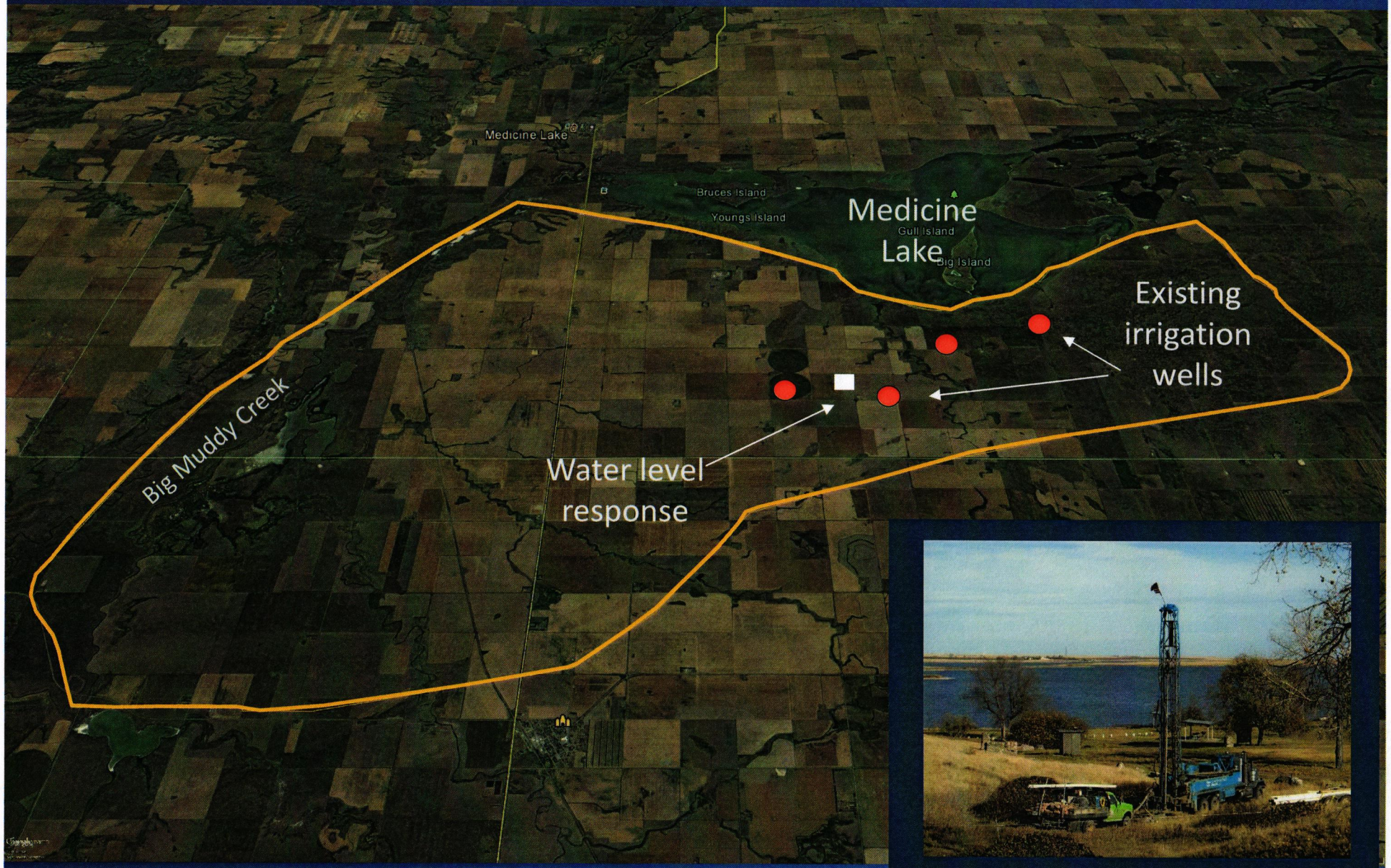
# CLEAR LAKE AQUIFER WATER RESERVATION

## SHERIDAN COUNTY CD

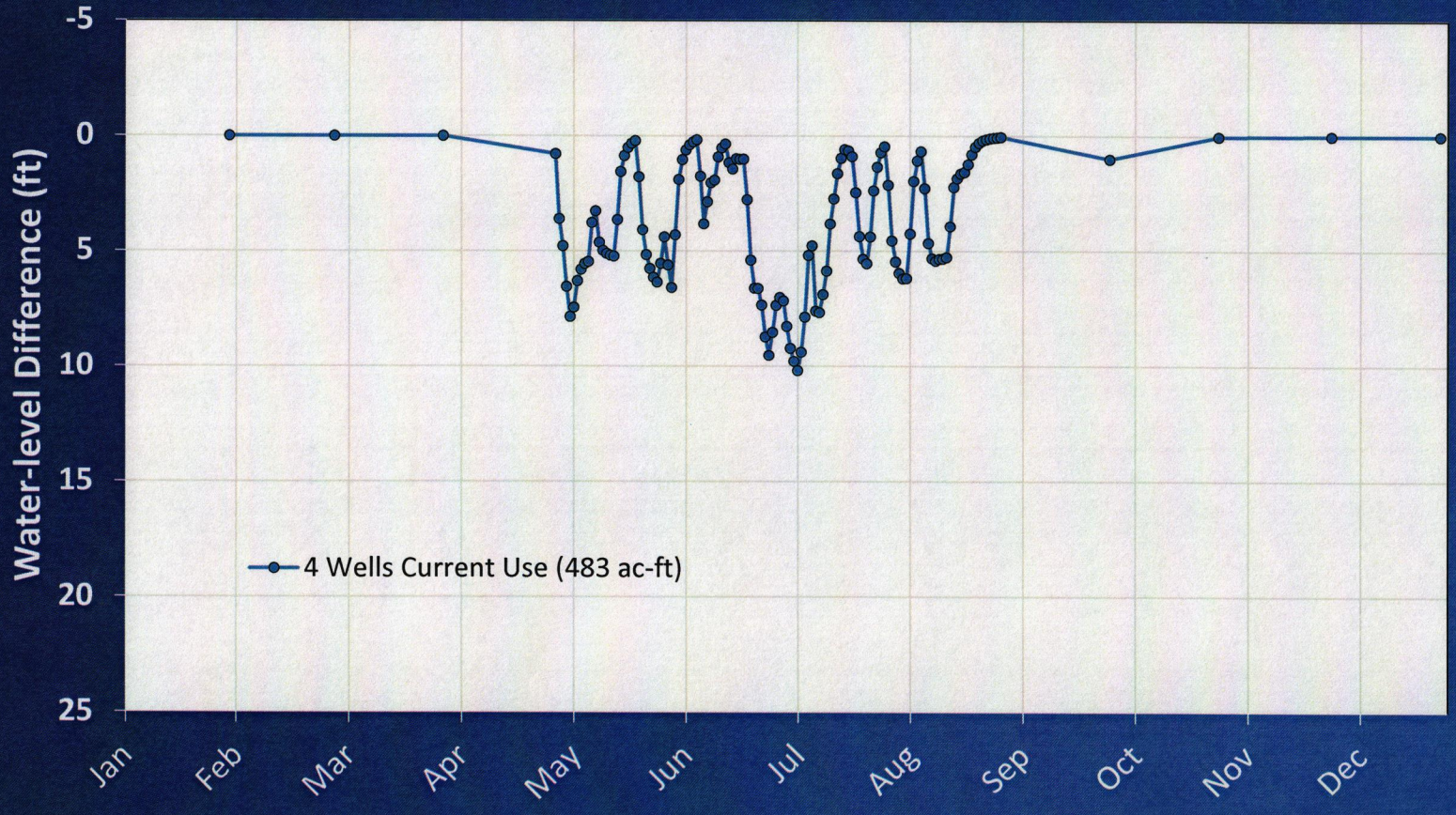


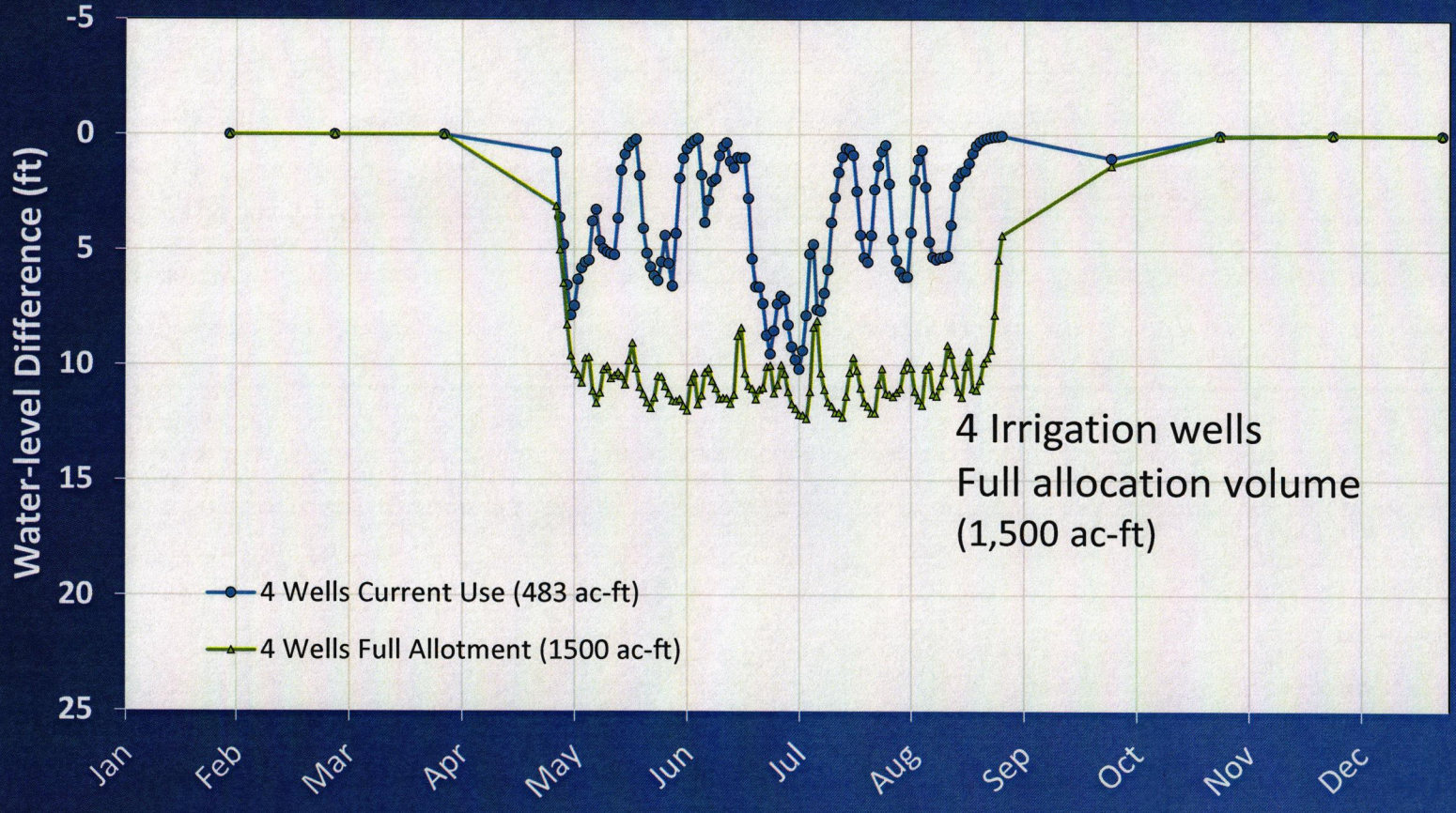
# CLEAR LAKE AQUIFER WATER RESERVATION



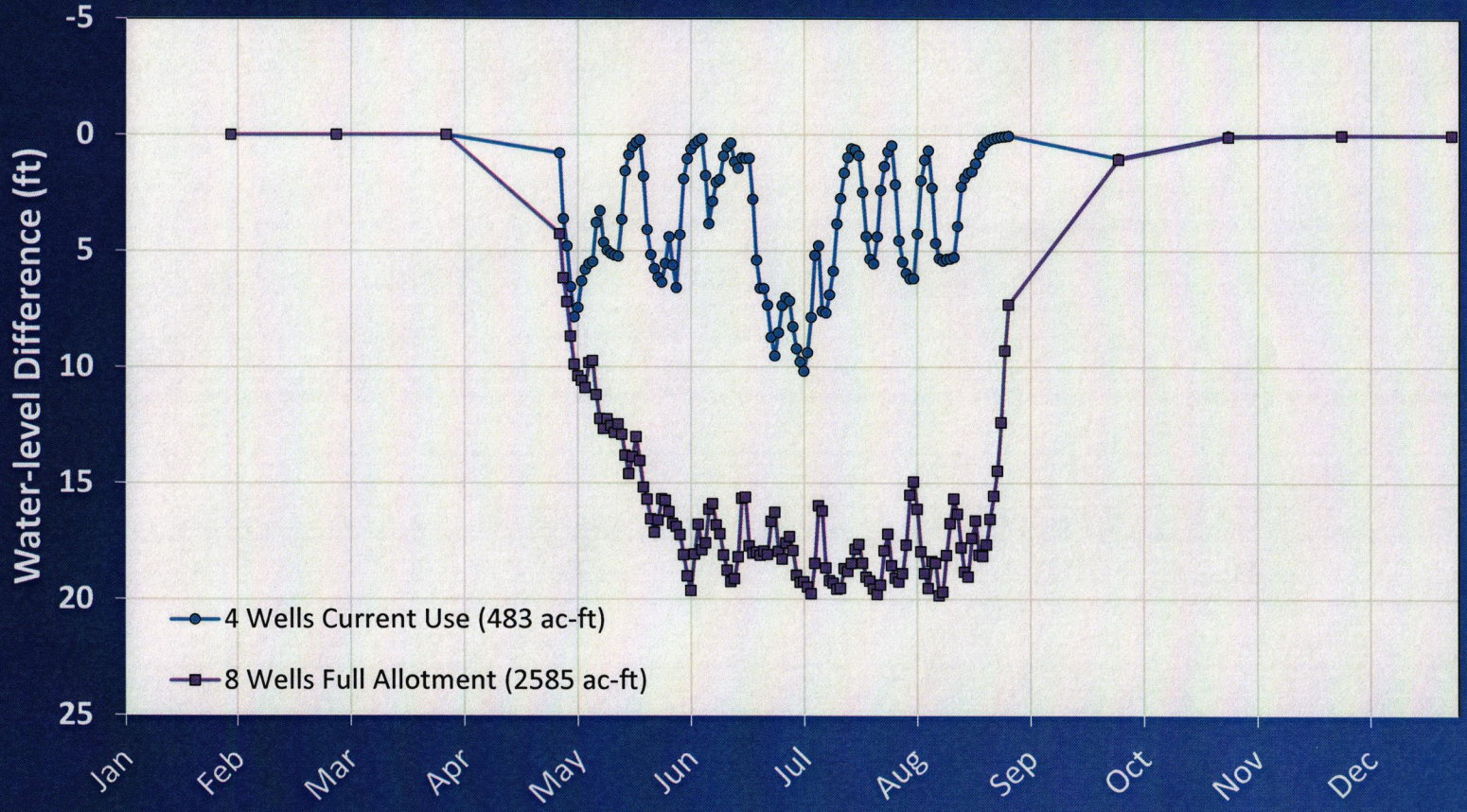
# Modeled Water Levels based on Water use (2015)



# Modeled Water Levels based on Water use



# Modeled water levels based on predicted water use



# Water Resource Management

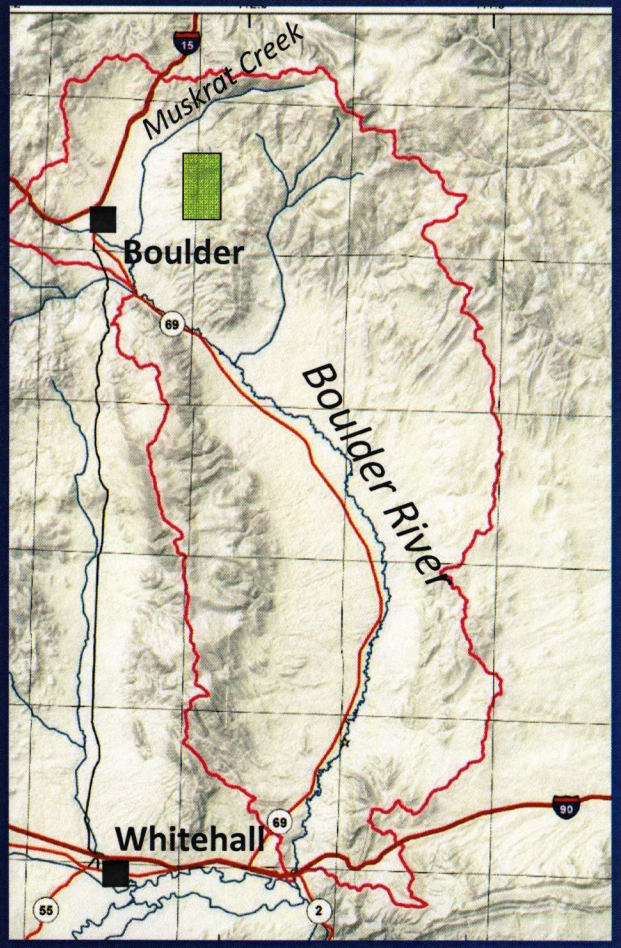
- Irrigation has not overdeveloped water resources.
- The aquifer in the focus area is not hydraulically connected to Medicine Lake.
- The groundwater model predicted that doubling the current irrigation volume resulted in no significant depletion to Big Muddy Creek.

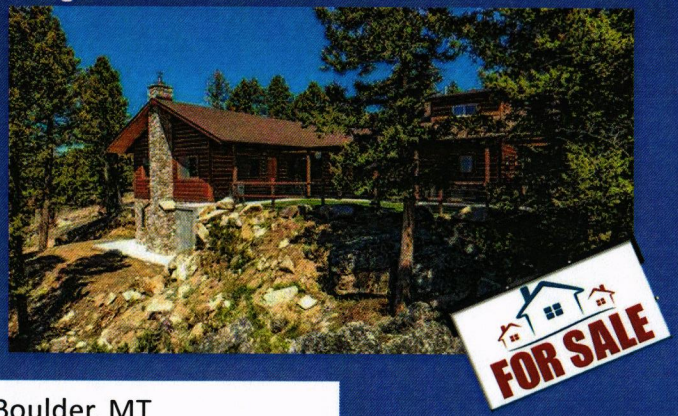
# Boulder River Watershed

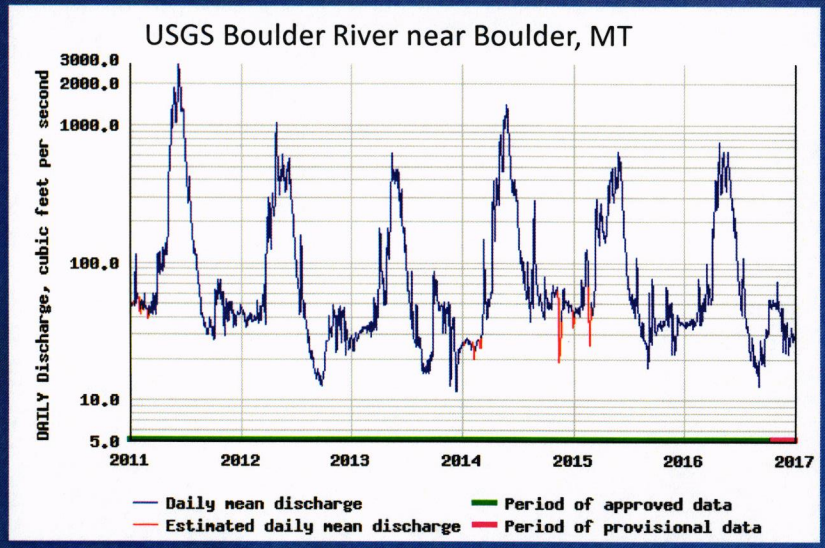
## Subdivisions…

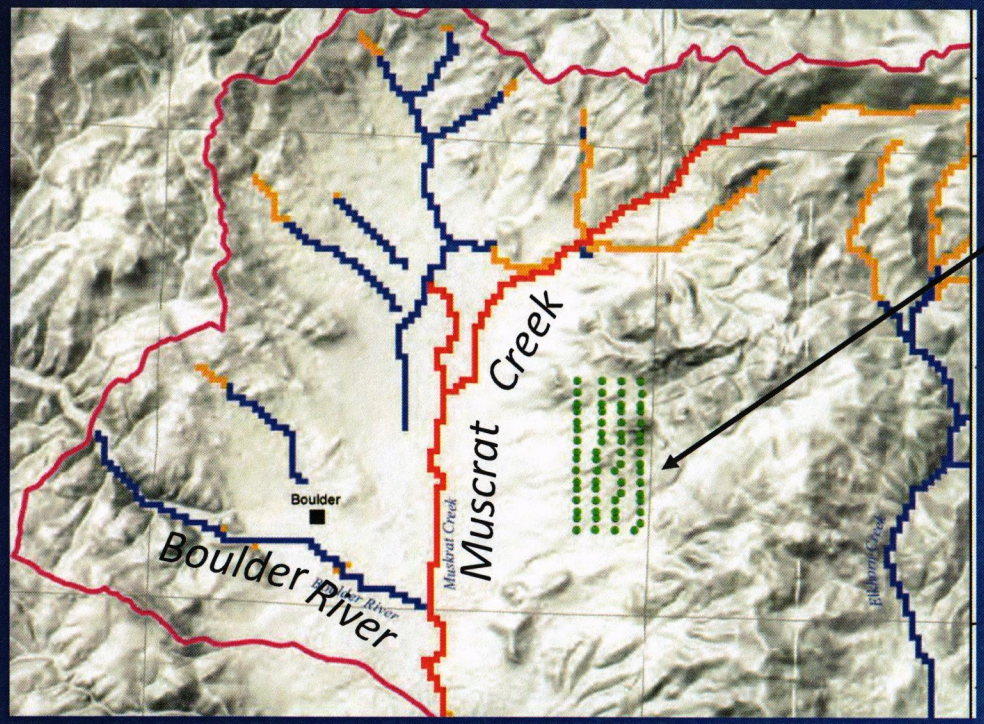
## Exempt wells…..

## Stream depletion






Simulating 10-acre lots

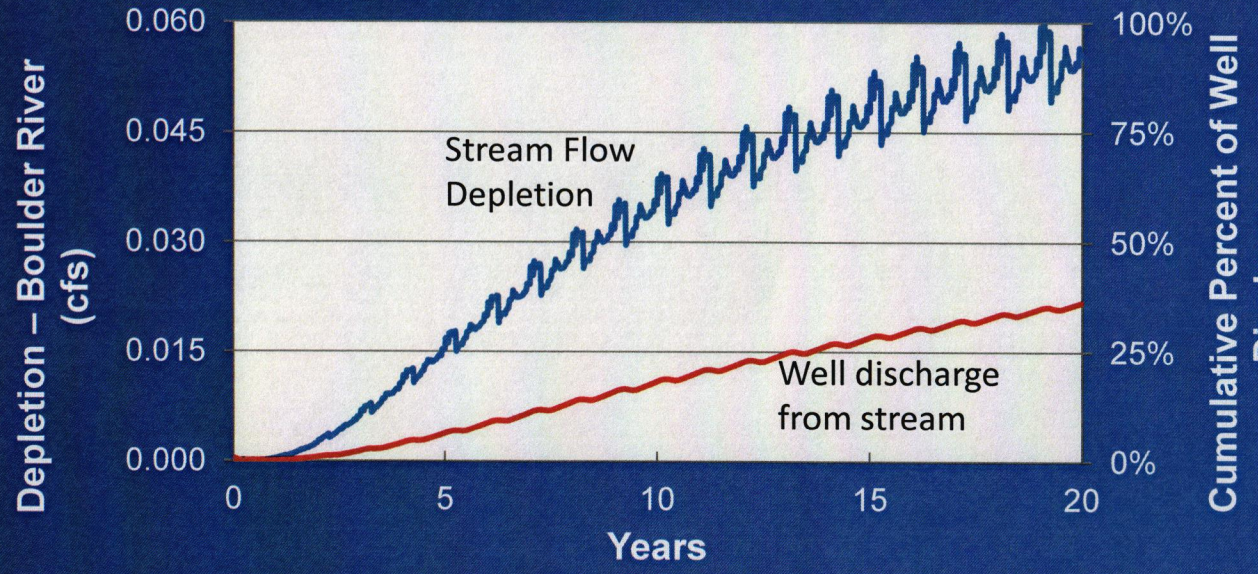
64 Wells

# Boulder River Watershed

>1% Depletion in Baseflow

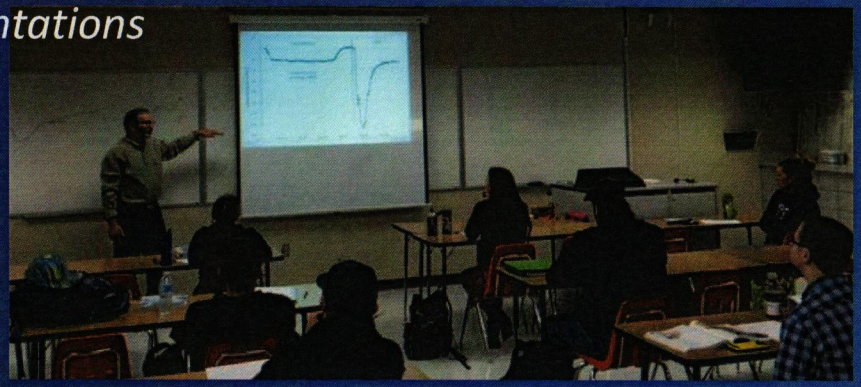
Dry Reaches

Modeled Stream Network



# Getting word out…

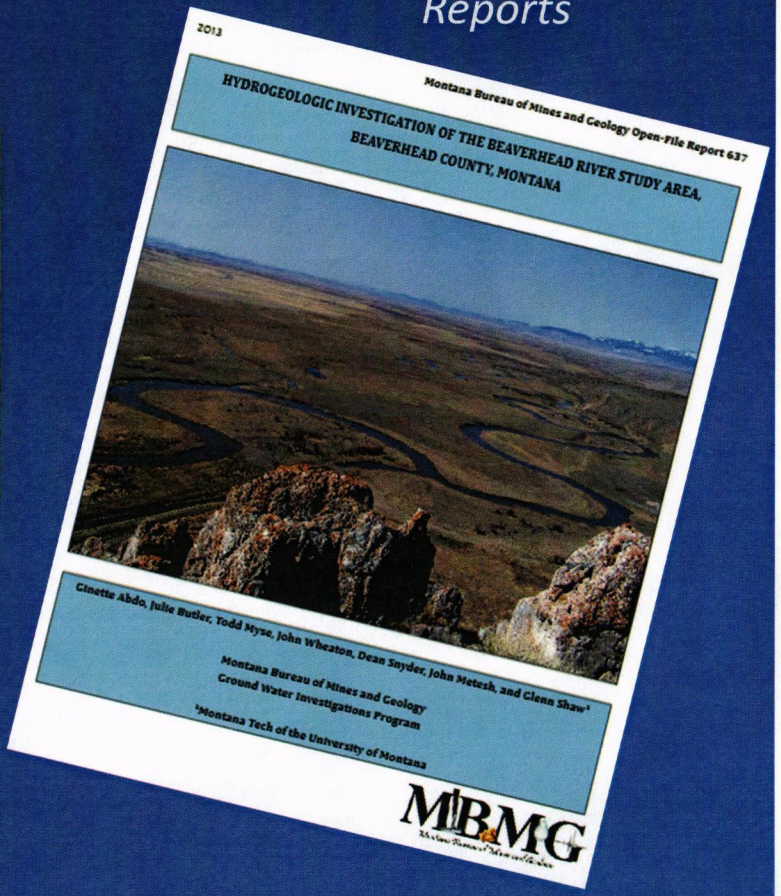
*Public presentations*



*Education*

*Inquiries*

*Reports*



# Call for Nominations
# Ground Water Steering Committee

The Montana Department of Natural Resources & Conservation

Montana State Library

DEQ Montana Department of Environmental Quality

Montana Department of Agriculture

Legislative Services 2017

U.S. Department of the Interior Bureau of Land Management

USGS science for a changing world

U.S. Forest Service

Montana University System

EPA

MACo Montana Association of Counties

Reclamation Managing Water in the West

DNRC Montana Board of Oil and Gas

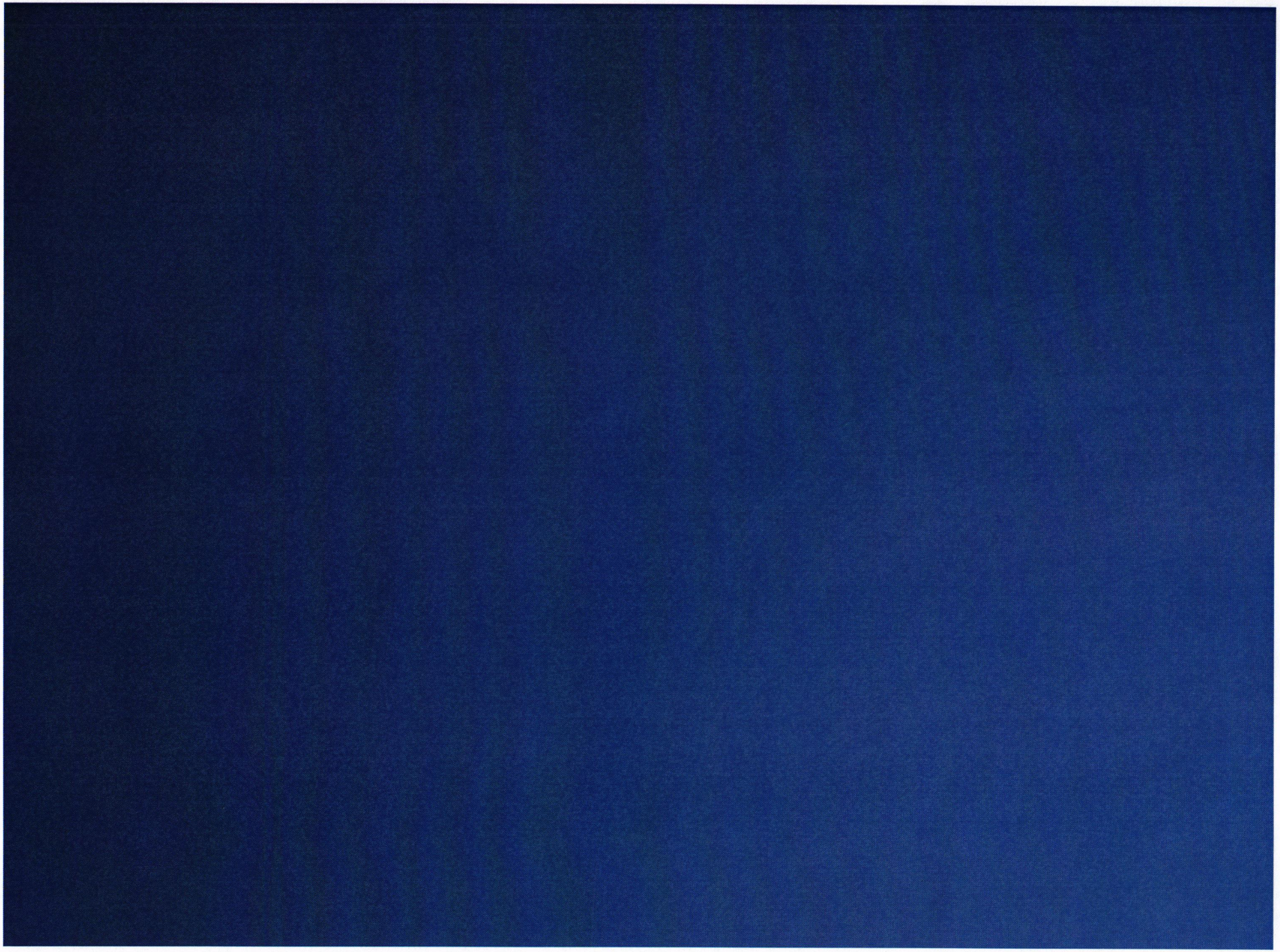
## Governor Appointees

Agricultural Water Users

Conservation Organization

Industrial water users

Development



# Surface Water Assessment and Monitoring Program

**HB107 by Rep. Glimm (HD 6)**
**HB360 by Rep. Hamlett (HD23)**

Section 1.

The MBMG shall develop and implement a surface water assessment and monitoring program for the purpose of collecting and compiling surface water information.

Steering Committee:

- DNRC
- DEQ
- MDA
- MSL, NRIS
- At least one representative of tribal governments in Montana

# Surface Water Assessment and Monitoring Program

Section 1 (continued).

Steering Committee may include representatives of:

- the Legislative Services Division;
- the Board of Oil and Gas Conservation;
- the Montana Bureau of Mines and Geology;
- a Soil and Water Conservation District;
- a unit of the Montana University System
- a county government
- a city, town, or city-county government
- each principal federal agency (EPA, USGS, BOR…)

Ex-officio members appointed by Governor:

- agricultural water users;
- industrial water users;
- a conservation or ecological protection organization; and
- the development community.

# Surface Water Assessment and Monitoring Program

Section 1 (continued).

Steering Committee duties:

Prioritize subbasins for investigation based on current and anticipated growth of agriculture, industry, housing, and commercial activity.

Permit applications for the development of surface water or ground water and the timing of the adjudication of water rights may be taken into account when prioritizing subbasins.

**HB107:** Sections 2-4 provided a statutory appropriation of $250,000 for effective July 1, 2017 through June 30, 2025

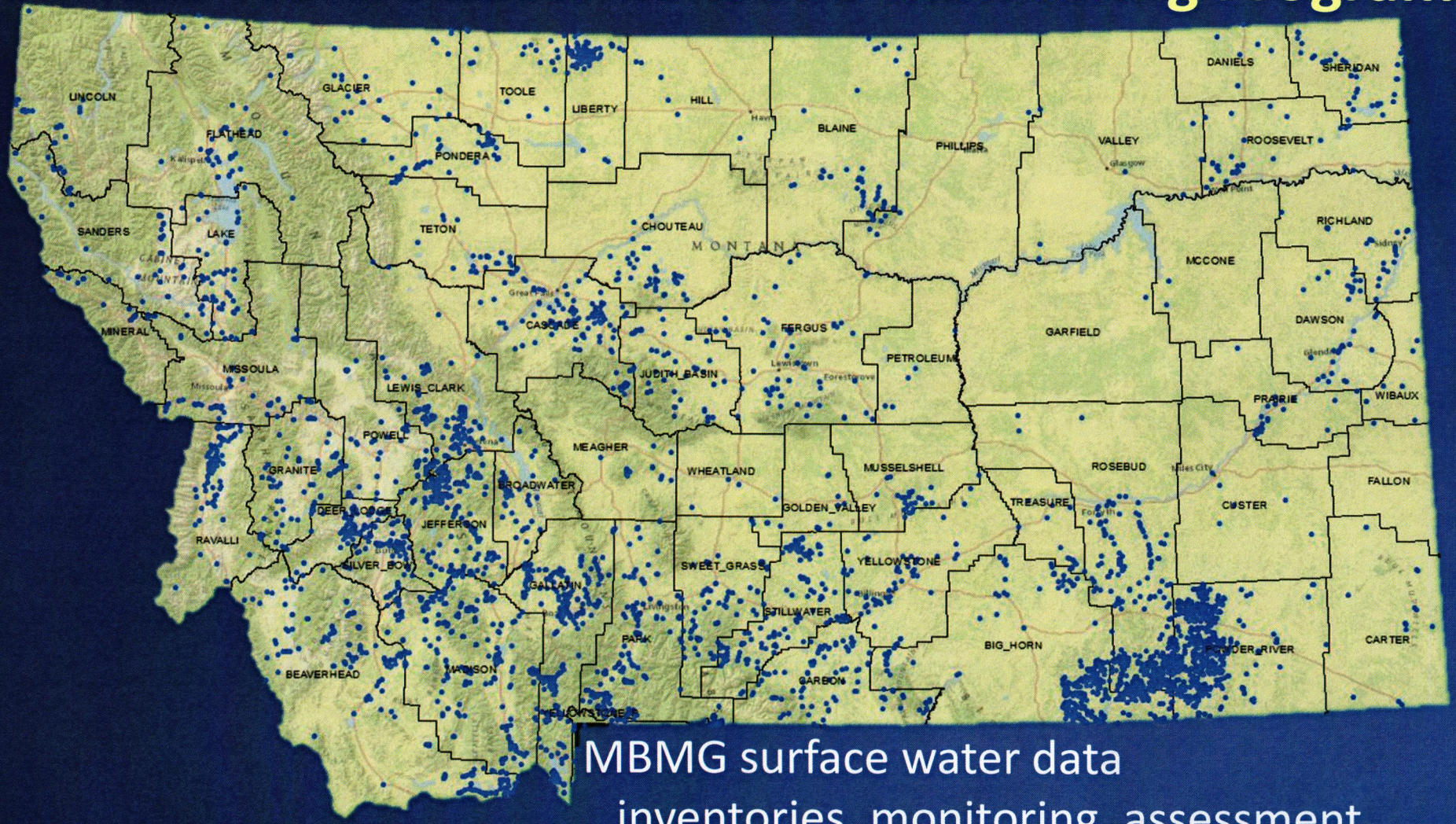
**HB360:** no funding provided

# Surface Water Assessment and Monitoring Program

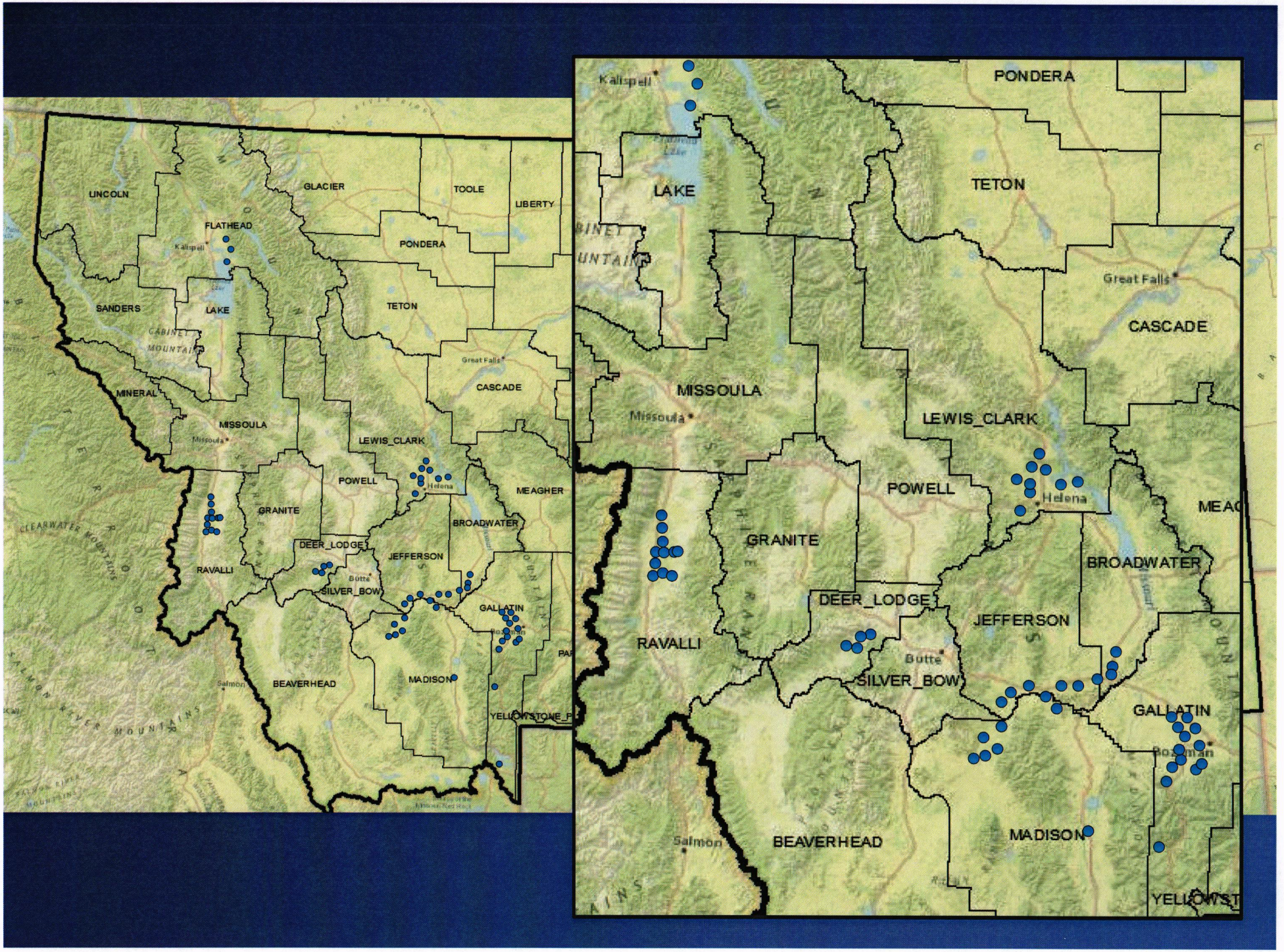
**HB107:** "Died in Standing Committee" (Sen. F&C)

**HB360:** "Passed with amendments"

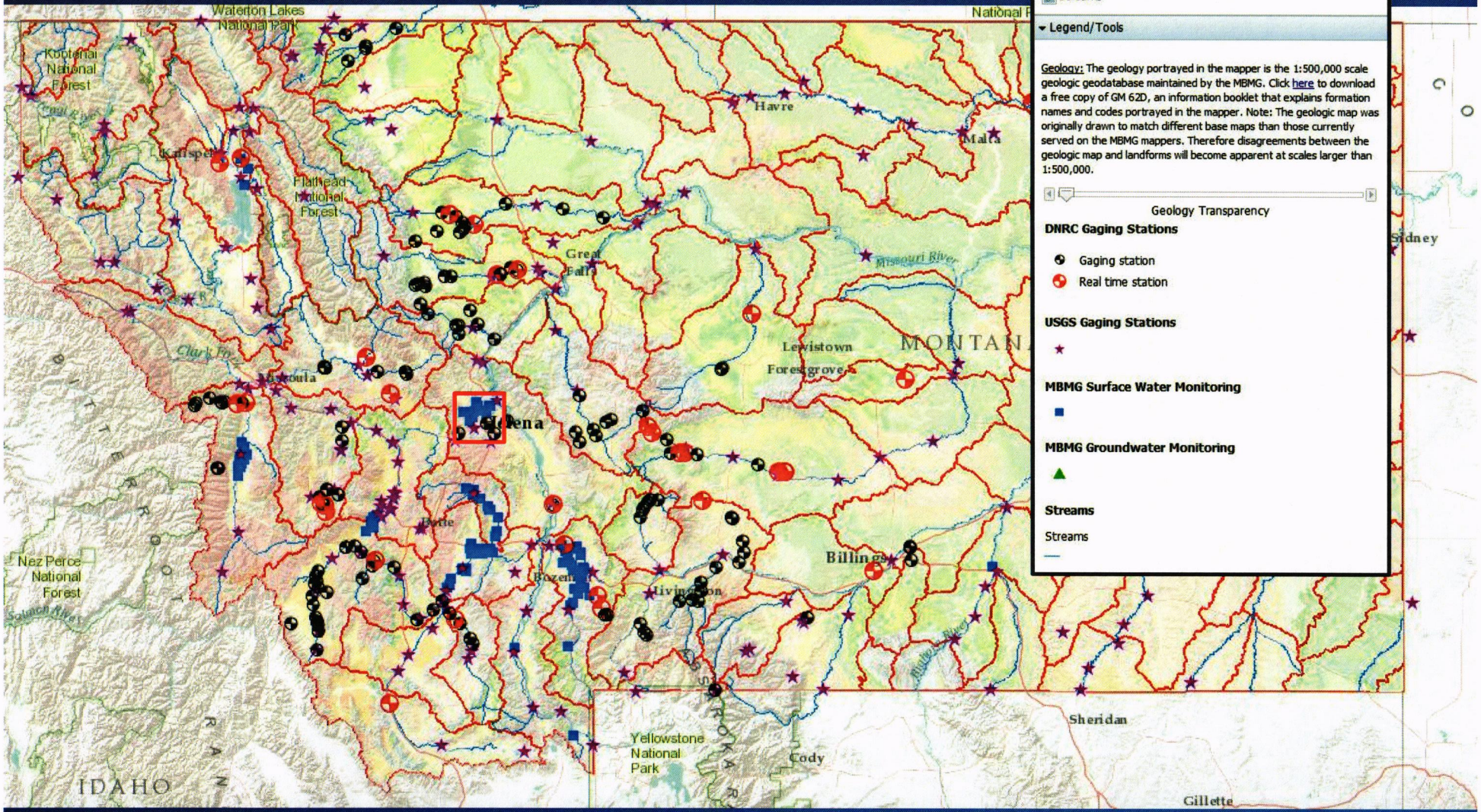
# Surface Water Assessment and Monitoring Program

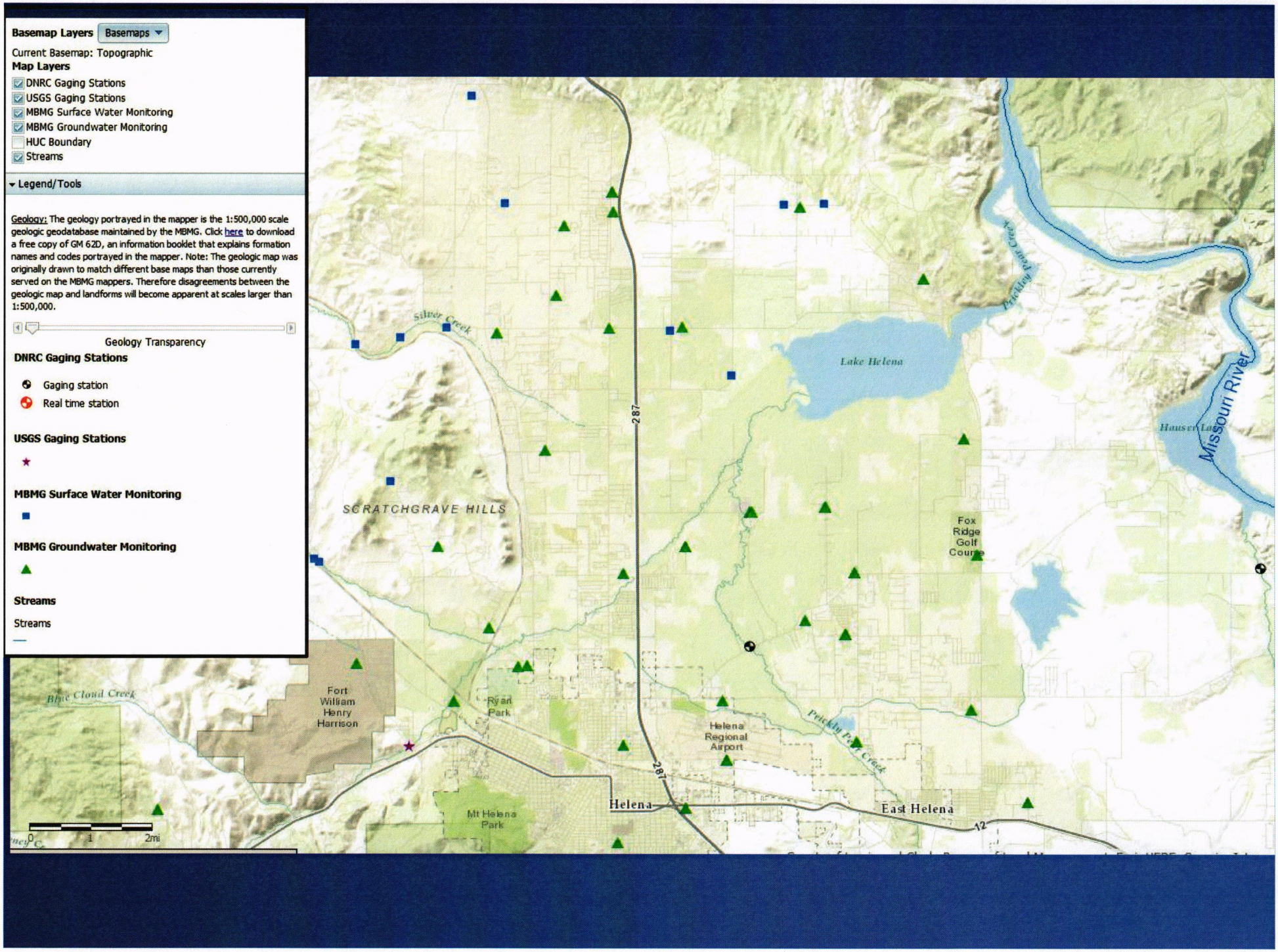


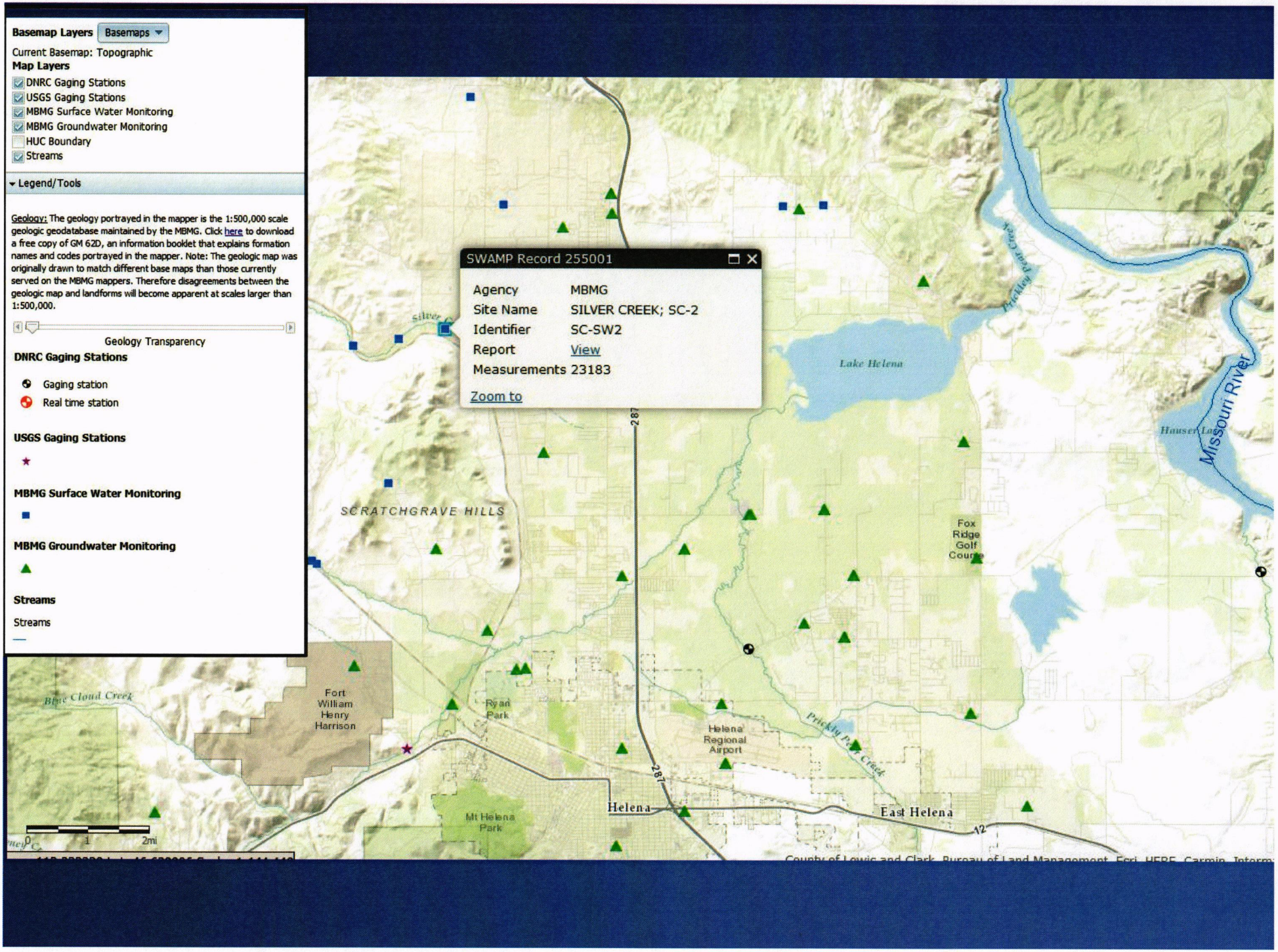

MBMG surface water data inventories, monitoring, assessment (eg return flow studies)


LINCOLN
GLACIER
TOOLE
LIBERTY
FLATHEAD
Kalispell
PONDERA
SANDERS
LAKE
TETON
CABINET MOUNTAINS
Great Falls
CASCADE
MINERAL
MISSOULA
Missoula
LEWIS_CLARK
POWELL
Helena
MEAGHER
GRANITE
BROADWATER
CLEARWATER MOUNTAINS
DEER_LODGE
JEFFERSON
RAVALLI
Butte
SILVER_BOW
GALLATIN
BITTERROOT MOUNTAINS
Salmon
BEAVERHEAD
MADISON
YELLOWSTONE_P
PONDERA
Kalispell
LAKE
TETON
Great Falls
CASCADE
MISSOULA
Missoula
LEWIS_CLARK
POWELL
Helena
GRANITE
BROADWATER
DEER_LODGE
JEFFERSON
RAVALLI
Butte
SILVER_BOW
GALLATIN
Bozeman
Salmon
BEAVERHEAD
MADISON

# http://www.mbmg.mtech.edu/datacenter/datacenter.asp




Basemap Layers
Basemaps
Current Basemap: Topographic
Map Layers
DNRC Gaging Stations
USGS Gaging Stations
MBMG Surface Water Monitoring
MBMG Groundwater Monitoring
HUC Boundary
Streams
Legend/Tools
Geology: The geology portrayed in the mapper is the 1:500,000 scale geologic geodatabase maintained by the MBMG. Click here to download a free copy of GM 62D, an information booklet that explains formation names and codes portrayed in the mapper. Note: The geologic map was originally drawn to match different base maps than those currently served on the MBMG mappers. Therefore disagreements between the geologic map and landforms will become apparent at scales larger than 1:500,000.
Geology Transparency
DNRC Gaging Stations
Gaging station
Real time station
USGS Gaging Stations
MBMG Surface Water Monitoring
MBMG Groundwater Monitoring
Streams
Streams
Silver Creek
Lake Helena
Missouri River
SCRATCHGRAVE HILLS
Fox Ridge Golf Course
Blue Cloud Creek
Fort William Henry Harrison
Ryan Park
Helena Regional Airport
Mt Helena Park
Helena
East Helena
287
12
0
1
2mi


Basemap Layers
Basemaps
Current Basemap: Topographic
Map Layers
DNRC Gaging Stations
USGS Gaging Stations
MBMG Surface Water Monitoring
MBMG Groundwater Monitoring
HUC Boundary
Streams
Legend/Tools
Geology: The geology portrayed in the mapper is the 1:500,000 scale geologic geodatabase maintained by the MBMG. Click here to download a free copy of GM 62D, an information booklet that explains formation names and codes portrayed in the mapper. Note: The geologic map was originally drawn to match different base maps than those currently served on the MBMG mappers. Therefore disagreements between the geologic map and landforms will become apparent at scales larger than 1:500,000.
Geology Transparency
DNRC Gaging Stations
Gaging station
Real time station
USGS Gaging Stations
MBMG Surface Water Monitoring
MBMG Groundwater Monitoring
Streams
Streams
SWAMP Record 255001
Agency MBMG
Site Name SILVER CREEK; SC-2
Identifier SC-SW2
Report View
Measurements 23183
Zoom to
Lake Helena
Missouri River
SCRATCHGRAVE HILLS
Fox Ridge Golf Course
Fort William Henry Harrison
Ryan Park
Helena Regional Airport
Mt Helena Park
Helena
East Helena
Blue Cloud Creek
Prickly Pear Creek
287
12
0 1 2mi

Helena Valley Reservoir - Ge | MBMG Web Mapping Applicatio | Montana's Ground-Water In

mbmggwic.mtech.edu/sqlserver/v11/reports/swamp/Report.asp?gwicid=255001&agency=mbmg&reqby=M&

80% Search

**Location Details**

**Site Type:** STREAM
**State:** MT
**County:** LEWIS AND CLARK
**USGS Quad:** SCRATCHGRAVEL HILLS

**Location (TRSQ):** 11N 04W 14 CDDC
**Location (Lon/Lat):** -112.076344, 46.7044776
**Geomethod/Datum:** SUR-GPS/WGS84

**Last Recorded Measurement**

**Date:** 12/15/2011 3:11:22 PM
**Gage Height (ft):** 0.8829
**Water Surface Elevation (ft):** 3889.8229
**Water Temp (C):**
**Discharge (cfs):** 1.1583
**Crest Gage:**
**Agency:** MBMG
**Method:** DIGITAL LOGGER
**Remarks:**

**Current Measuring Point Records**

| MP | Date | Description |
|---|---|---|
| 3888.94 | 1/21/2010 | 0.0 ON STAFF GAUGE |

**Data Summary by Dataset**

| Agency | Method | Disch Meas | Stage Meas | Crest Meas | Temp Meas | First Meas | Last Meas |
|---|---|---|---|---|---|---|---|
| LCWQPD | CURRENT METER | 2 | 2 | 0 | 0 | 8/10/2011 | 10/20/2011 |
| MBMG | CURRENT METER | 16 | 16 | 0 | 13 | 3/25/2010 | 4/12/2011 |
| MBMG | DIGITAL LOGGER | 11,283 | 11,283 | 0 | 6,526 | 1/21/2010 | 12/15/2011 |
| MBMG | STAFF GAUGE | 0 | 0 | 0 | 0 | 7/21/2011 | 7/21/2011 |

**Field Visit Records**

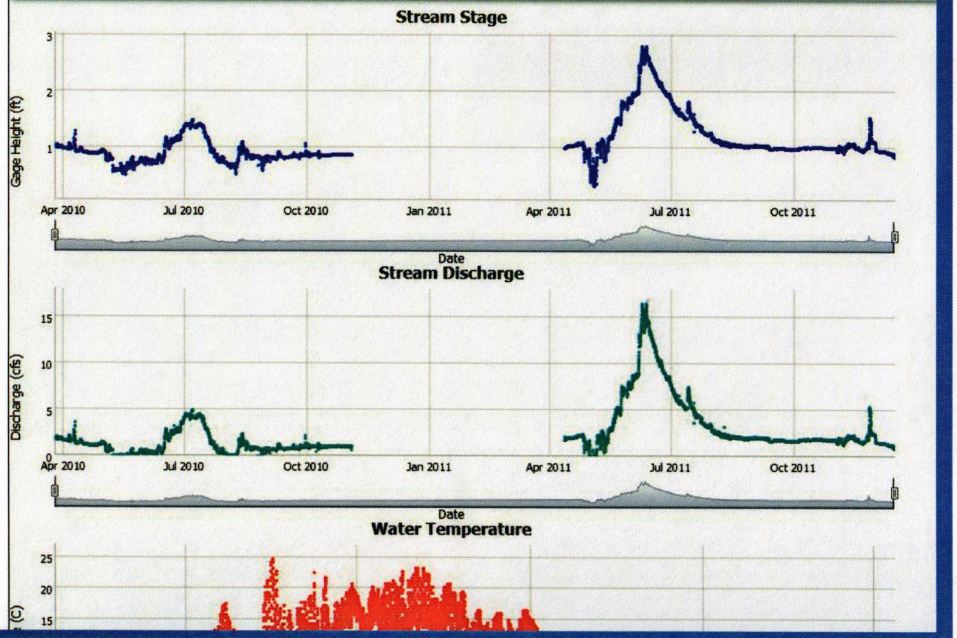
| Report | Agency | Staff | Date | Sampled | Project |
|---|---|---|---|---|---|
| Summary | MBMG | MADISON, JANE | 10/20/2011 10:45:00 AM | | BWIPNH |
| Summary | MBMG | MADISON, JANE | 8/10/2011 10:08:00 AM | | BWIPNH |
| Summary | MBMG | MADISON, JANE | 4/12/2011 3:20:00 PM | | BWIPNH |
| Summary | MBMG | KIRK WAREN | 11/3/2010 4:27:00 PM | NO | BWIPSG |
| Summary | MBMG | MADISON, JANE D. | 10/8/2010 9:55:00 AM | YES | BWIPSG |
| Summary | MBMG | JANE MADISON | 9/22/2010 1:11:00 PM | NO | BWIPSG |
| Summary | MBMG | JANE MADISON | 9/8/2010 10:20:00 AM | NO | BWIPSG |
| Summary | MBMG | JANE MADISON | 8/25/2010 2:10:00 PM | | |
| Summary | MBMG | MADISON, JANE | 8/12/2010 1:58:00 PM | | BWIPSG |
| Summary | UNKNOWN | WAREN, KIRK | 8/11/2010 12:40:00 PM | | BWIPSG |
| Summary | MBMG | MADISON, JANE | 7/28/2010 10:31:00 AM | | BWIPNH |
| Summary | MBMG | MADISON, JANE | 7/14/2010 12:53:00 PM | | BWIPNH |
| Summary | MBMG | MADISON, JANE | 6/23/2010 11:16:00 AM | | BWIPNH |
| Summary | MBMG | MADISON, JANE | 6/8/2010 4:00:00 PM | | BWIPNH |
| Summary | MBMG | MADISON, JANE | 6/8/2010 4:00:00 PM | | BWIPNH |
| Summary | MBMG | MADISON, JANE | 6/8/2010 4:00:00 PM | | BWIPNH |
| Summary | MBMG | MADISON, JANE | 5/26/2010 11:47:00 AM | | BWIPNH |
| Summary | MBMG | MADISON, JANE | 5/13/2010 10:39:00 AM | | BWIPNH |
| Summary | MBMG | JANE MADISON | 4/27/2010 4:11:00 PM | | |
| Summary | MBMG | BOBST, ANDY | 4/6/2010 3:00:00 PM | YES | BWIPSG |
| Summary | MBMG | BOBST, ANDY | 4/6/2010 3:00:00 PM | YES | BWIPSG |
| Summary | MBMG | JANE MADISON | 3/25/2010 2:37:00 PM | | |

22 field visit record(s) listed.

**Data Downloads**

TEXT Document | HTML | Excel

**Graphs**



# Looking forward…

**Steering Committee meeting(s)**

if it is anything like the GW Steering Committee…

**Farmers Canal** – a mini-HB831 study

MT Tech Research Grant (OTO) + Federal (?)

canal efficiency (design options)
data needs for modeling
diagnostic/indicator chemistry/isotopes

if it weren't for the cooperation and infrastructure…

# Contact Information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MBMG
Montana Bureau of Mines and Geology

**Montana Bureau of Mines and Geology:**
**http://www.mbmg.mtech.edu/**